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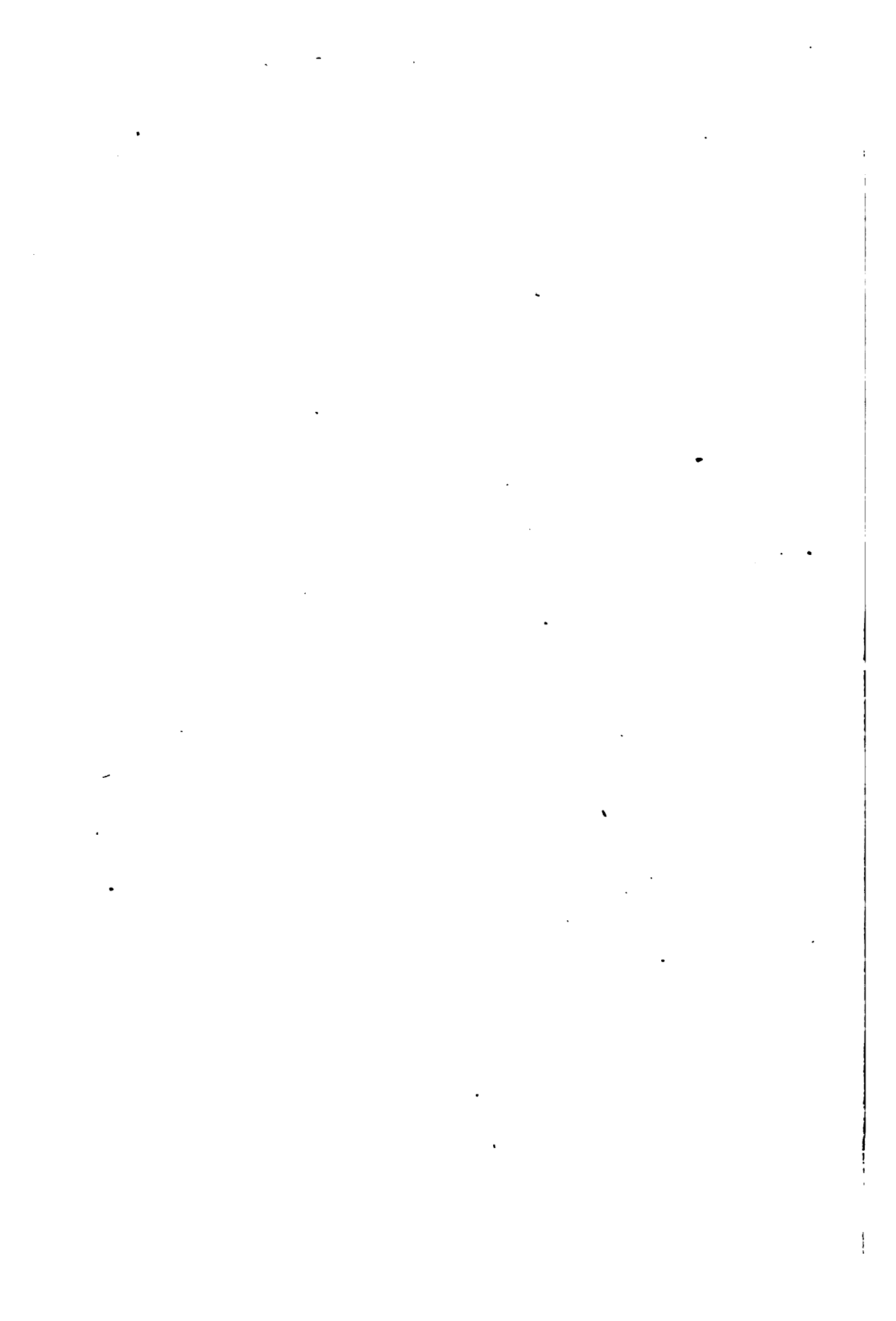
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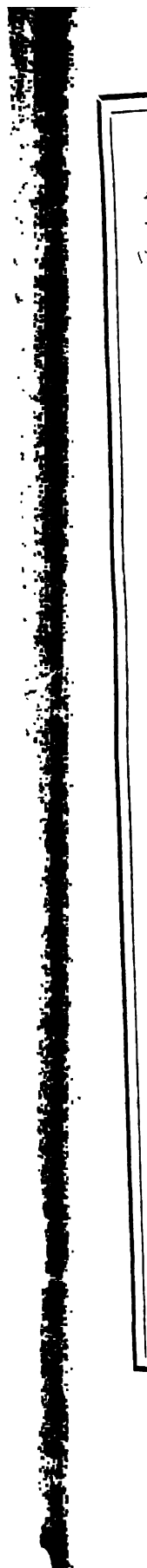
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ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR

ANNUAL REPORT

(NEW SERIES)

VOLUME VI

REPORTS A (1892), A (1893), J, Q, R, S

1892-93



OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST
EXCELLENT MAJESTY
1895

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REPORTS AND MAPS

OF

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To the Honourable

T. MAYNE DALY, M.P.,

Minister of the Interior.

SIR,—I have the honour to submit herewith Volume VI. (New Series) of the Reports of the Geological Survey of Canada.

This volume is small as compared with previous issues, but as the state of the appropriation for the fiscal year renders it impossible to proceed with the printing of further matter at present, it appears to be desirable to complete and issue the volume as it stands.

Several important manuscript reports, with a number of maps, are now ready for the printer and engraver, and these it is hoped it may shortly be found possible to publish in a succeeding volume.

Each of the constituent parts of the present volume may be obtained separately at prices ranging from ten to twenty-five cents.

I have the honour to be, Sir,

Your obedient servant,

GEORGE M. DAWSON,

Acting Director, Geological Survey.

OTTAWA, January 1, 1895.

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SUMMARY REPORT

OF THE

OPERATIONS OF THE GEOLOGICAL SURVEY

FOR THE YEAR 1892.

1st January, 1893.

The Hon. T. MAYNE DALY, M.P.,
Minister of the Interior.

SIR,—I have the honour, in compliance with Section 6 of the Act 53 Victoria, Chap. XI., to submit a summary report of the proceedings and work of the Geological corps during the year now closed.

The work during 1892 has been for the most part a continuation and extension of that recorded in the preceding years 1890 and 1891. The progress made in working out the structural details, and mapping the districts in part examined in those years has been satisfactory, while some extensive and hitherto wholly unknown areas south of Lake Athabasca, and east of James' Bay have been examined with interesting results, while important additions have also been made to our knowledge of the geologic and geographic features of these regions.

The working field parties, during the past year, numbered fifteen, distributed as follows :—

British Columbia.....	1
North-western Alberta and Columbia Valley...	1
Between Lake Athabasca and Reindeer Lake...	1
Ontario.....	4
Quebec.....	3
East Main.....	1
New Brunswick.....	1
Nova Scotia.....	3

As in previous years, Messrs. Macoun, Ami, Weston and Willimott have made investigations and collections in botany, palæontology and mineralogy, the particulars of which are given under the divisions named. Dr. G. M. Dawson's time and attention has been occupied, as in 1891, almost entirely with work in connection with the Behring Sea Commission, and he has, therefore, been unable to do any geological

field work. The exploration in British Columbia has, however, been ably carried on by his assistant, Mr. McEvoy, who has also completed the drawing on stone of the orographical features of the Kamloops sheet.

In the Summary Report for 1891 it was stated (p. 8 A), that the boring at Deloraine had reached a depth of 1,808 feet, and that the total expenditure to the 31st of December, 1891, had been \$15,494.80. Many unfortunate and unexpected accidents and delays have arisen in the prosecution of the work. On the 11th of July, I reached Deloraine and found that the water-bearing sands under the impervious clay shales had been reached that morning, and that a weak stream of somewhat saline water was flowing from the pipe; since then this flow was shut off by lowering the casing, and the boring was continued in the hope of securing a more copious supply. On the 22nd of September, when I again visited Deloraine, a total depth of 1,943 feet had been reached, or 121 feet into the Dakota formation, consisting of layers of coarse and fine white quartz sand, with hard streaks of sand-rock, holding occasionally concretionary nodules of pyrites. After the casing was lowered as above mentioned, the water no longer flowed over, except when the boring rods were being inserted, and then not till from six to nine lengths of about thirty feet each, had been put down, indicating the water to stand permanently at about 100 feet below the surface.

Though too saline for drinking, as shown by the quantitative analysis below, it is clear and soft, and unlike the water of the shallow wells of the district, lathers readily with soap, and would, therefore, be a useful and wholesome water for domestic purposes. Deloraine is 1,630 feet above sea-level, and thus it seems almost certain that at any height not exceeding 1,500 feet above tide, strong flowing artesian water might be obtained from the Dakota sands. The eastern outcrop of these sands was observed in 1889, by Mr. J. B. Tyrrell (Geol. Survey of Canada, Ann. Rep. vol. iv., p. 23 A), on some terraces at the south end of Swan Lake, near the foot of the Manitoba escarpment in the Riding Mountains, about 120 miles north of Deloraine, and about 1,000 feet above the sea. This outcrop is evidently here the eastern rim of the great water-bearing basin, of the Dakota formation of Western Manitoba, which has now been struck at Deloraine, 215 feet below sea-level, and 1,205 feet below its eastern rim in the Manitoba escarpment.

Further south the Cretaceous escarpment which forms this rim sinks below the level of the country, and both it and the underlying Palæozoic and Archæan rocks are deeply covered and entirely concealed by the deposits of Glacial Lake Agassiz. It appears that the

flow of the water in the well at Deloraine is much impeded by the loose nature of the sand causing it to run in and block the pipe; a similar difficulty occurred at the Devil's Lake well in Dakota and in many other cases, but it has been found that by continued pumping, or natural flowing, the sand after a time ceases to run, and the available supply, as well as the quality, of the water, improves. Arrangements have, therefore, now been made to place a pump in the Deloraine well in order to satisfactorily test this matter. Supposing, as we do, that the main supply of water is derived from much higher levels to the westward, it seems probable that the natural pressure to be expected in the well at Deloraine may be so much relieved by outflow along the above described eastern rim of the basin, as to prevent any overflow at elevations greatly exceeding the level of that rim, which is as stated, about 1,000 feet above the sea level. Further south the edge of the basin, or outcrop of the water-bearing Dakota sands must be considerably lower, but is completely sealed by the overlying clay deposits of Lake Agassiz, and hence, perhaps, the greatly increasing pressure to the south, as manifested by the wells of the James' River valley in Dakota, and also the swampy character of the country, below the rim of the basin to the north. The result of pumping the Deloraine well will be most interesting, whether viewed from an economic or from a purely scientific stand-point.

A sample of the water analysed in the chemical laboratory of the Survey gave the following result :—

	Grains.
Chloride of potassium.....	1·562
Chloride of sodium.....	309·502
Sulphate of soda.....	28·196
Bi-carbonate of soda.....	94·409
Bi-carbonate of lime.....	3·961
Bi-carbonate of magnesia.....	3·581
Carbonic acid, free.....	5·044
Organic matter.....	none
	447·255

grains per imperial gallon.

Specific gravity at 60 F., 1004·99.

Boiling produced a slight precipitate consisting of carbonate of lime with a little carbonate of magnesia.

The water of the artesian well at Jamestown, Dakota, contains 129·2496 grains per gallon. I have not been able to find an analysis of the water from the Devil's Lake well. It would, however, be between that of Jamestown and Deloraine in saline contents.

On pages 71 A and 86 A of the Summary Report for 1891, it was stated that geological and botanical collections had been made and were being prepared for the proposed museum in the Rocky Mountain park at Banff. In July I visited Banff to inspect the building, then unfinished, and to ascertain what was required to complete it and adapt it for the purpose contemplated: also to ascertain the dimensions and the kind of cases that would be most suitable for the specimens. This was carried out, a plan of the rooms was made, some alterations suggested, and the position and kind of cases, fifteen in number, determined on. These are now being made in Ottawa, and will be ready to be placed early in the ensuing spring. They will afford about 1,444 square feet of glass frontage, upright and flat. A fair collection of animals, fossils, minerals, and rocks will be ready to be placed on exhibition, as soon as the cases are completed, as well as maps and photographs. A herbarium also, containing named species of all the plants growing in the Park and vicinity, has been prepared by Professor Macoun.

On the 20th of July I visited section 11, township 2, range 23, on the flank of the Turtle Mountains, south of Deloraine. On the north-west quarter of this section, the owner, Mr. Duncan McArthur, has sunk several shallow pits, and a shaft 23 feet deep, in which he states three seams of lignite coal were found with intervening clay strata.

1st seam at seventeen feet.....	2' 6"
2nd seam at (?)	2' 6"
3rd seam at twenty-three feet thickness not ascertained.	

All the workings were full of water at the date of my visit.

From the specimens of the lignite shown me by Mr. McArthur, it appears to be of similar quality to that now being mined at Estevan, and would certainly be a valuable fuel for local use if mined and sold at a reasonable figure.

These are doubtless the same seams as those described in the Geological Survey Summary Report for 1890, page 10, as having been opened in range 24, township 1. It was then stated the seam would probably be found from range 19 to range 34, in township 1. It is now proved that they extend in places at least a mile into township 3, or thirteen miles north of the international boundary.

On the 7th of August I left Ottawa for Quebec, where in company with Mr. Weston, some examinations were made with a view to determine the hitherto doubtful question of the relation of the black graptolitic bitumino-calcareous shales of the Citadel Hill, to the Trenton. In this we were completely successful, and the evidence

obtained leaves no room to doubt that these shales are above, and not beneath the Trenton limestone, or in other words, that they occupy the position and represent, in a much disturbed and sharply folded attitude, the 'Utica Hudson terrane, the whole mass being squeezed in, and compressed between two great dislocations. The evidence of these dislocations abounds from the Falls of Montmorency and the Island of Orleans to Lake Champlain. That some beds older than Trenton are involved in these folds is quite likely, but these strata are certainly all newer than Levis.

On the 13th of August I left Quebec for Nova Scotia, where a few days were spent with Mr. Hugh Fletcher, examining and consulting on some doubtful points of structure in the Chignecto promontory and the Cobequid Hills, on the line of the Intercolonial, and the Spring Hill and Parrsboro' railways.

In the conclusions arrived at by Mr. Fletcher, I fully agree, and there can, I think, be no question that the crystalline rocks of the Cobequid Mountains are not Archæan but contemporaneous igneous ejections, and of Devonian-carboniferous age. Full details will be given in Mr. Fletcher's map and report on the district.

On the 29th of August I again reached Ottawa.

On the 22nd of September I was again at Deloraine, when it was concluded to stop the boring and to make arrangements to place a pump in the well, as already stated. On the 25th of September a trip was made to Estevan and the Souris River coal fields, which I had examined and reported on in 1880.*

At the Hassard mine, fourteen miles from Estevan, a very fine seam of lignite has been opened, and above it at the same point, there are three seams as under :

1—4 feet.....	12 feet below prairie level.
2—2 feet.....	40 do do
3—1 feet.....	50 do do
4—8 feet.....	80 do do

This eight-foot seam is only a few feet above the level of the Souris River, and being covered by debris and superficial deposits, was not seen either by Dr. Dawson, in 1874, or by myself in 1880. The Hassard mine is on the left bank of the Souris River, section 4, township 2, range 6, west of second meridian. The seam presents a solid tough lignite eight feet thick and of excellent quality. It is somewhat difficult to correlate the above section with that at the Estevan mine, but it seems quite unlikely that the eight-foot seam at Hassard's is, though thought to be so, the same seam as that now being worked at Estevan, and, as the latter is only 28 to 30 feet below the

*Geol. Survey of Can. Rep. of Progress, 1879-80, pp. A 2-26, ss.

prairie level, it seems much more probable that it is the same seam as the six feet seam shown in the figure, page 7 A, of the report 1880, above cited, and also as the seam in the old Sutherland mine, page 5 A of same report, in which case the Hassard seam would be below the bed of Long Creek at Estevan. In any case, there is an enormous quantity of available fuel in this field. In estimating the quantity in 1880 it was stated :—

“It may be assumed that there are in this region above the level of the Souris River at least eight feet of available lignite coal, over an area of not less than 120 square miles. This estimate would give 7,136,864 tons to the square mile, calculating the cubic foot at only 64 lbs.” *

On page 6 A of the Summary Report for 1891 it was stated that vol. V. of the Annual Report would probably be issued before the close of 1892. This has not been found possible, but four Parts have been issued, and the printing of six other Parts is now well advanced, while two more are ready to put in the printer's hands. Most of them are also translated, and it is hoped that the interval between the issue of the English and the French edition will be considerably less than heretofore.

The Annual Report, vol. V., will contain the following Parts, with maps, illustrations and sections :—

A—Summary Reports for 1890 and for 1891.

D—Peace and Athabasca Rivers, with index map and sections—McConnell.

E—North-western Manitoba, &c., with map and illustrations—Tyrrell.

F—Sudbury Mining District—Bell.

G—Geology of Hunters Island—Smith.

L—Geology and Economic Minerals of Portneuf, Quebec and Montmorency Counties, P.Q.—Low.

M—Report on a portion of the Province of Quebec and adjoining areas in New Brunswick and Maine, &c.—Bailey and McInnes.

P—Surveys and Explorations, Pictou and Colchester Counties, Nova Scotia—Fletcher.

Q—On Natural Gas and Petroleum in Ontario—Brumell.

R—Chemical Contributions—Hoffmann.

S—Mineral Statistics and Mines—Ingall.

On the 28th of December and following days, the Geological Society of America, on the joint invitation of the Royal Society of Canada and The Logan Club held its winter meeting in Ottawa. The proceedings were opened by an address of welcome to the visiting members of the society from His Excellency the Governor-General.

Instructive and interesting papers or communications were read and discussed, several of which were contributed by members of the Geological corps of Canada. The social features of the meeting were of a most agreeable nature, and even from a scientific aspect by no means unimportant. At the close of the meeting the following resolution "adopted cordially and unanimously" was transmitted to the Logan Club by the secretary of the society, Professor LeRoy Fairchild:

"Resolved—That the thanks of the Geological Society of America be heartily tendered to the Logan Club for its invitation to the Society to meet in Ottawa, and for its generous hospitality; and especially to its committee, consisting of Dr. A. R. C. Selwyn, Dr. Robert W. Ellis, Mr. Joseph B. Tyrrell, and Mr. W. H. Smith, whose untiring efforts have so largely contributed to the success of the meeting."

Mr. McEvoy left Ottawa on the 8th of June with instructions to continue the examination of that part of the southern interior of British Columbia, embraced by the Shuswap sheet, the situation of which was described in the Summary Report for 1891, p. 17 A. He was joined at Kamloops by his assistant, Mr. C. J. Bowell, and continued work in the mountains till the end of September. On the 8th of October he again reached Ottawa.

He reports on the season's work as follows:—

"Nearly all the roads and trails in the country having been previously examined and surveyed, the work of this season was necessarily difficult, as it involved travel on foot through trackless forests and over steep and lofty mountains.

"The first trip was made from Shuswap station, up Chase Creek and through a low pass to Tappen siding. A few days were spent exploring in the vicinity of White Lake. This lake has heretofore been known only from Indian report. It proved, however, to be only two miles long, and apparently very shallow. The name, a translation of the Indian one, is derived from the appearance of the water due to the white silt bottom.

"On the hills west of Armstrong, on the Shuswap and Okanagan Railway, near Davidson Creek, black chialstolite schist, like that of granite in Nova Scotia and elsewhere around were found. The conditions here are apparently similar to those in the east; the argillites or argillaceous schists become altered on approaching the granite, imperfect crystals of garnet appear, and still nearer the contact the typical chialstolite schist is found.

"About three weeks were spent in the country north of Shuswap Lake, around the headwaters of Scotch Creek. The mountains here are smooth-topped, about 6,800 feet high, and heavily glaciated over the summits. They are composed for the most part of gneisses and mica-schists of the Shuswap series, probably Archæan. On Scotch Creek, however, the overlying black argillaceous schists of the Nisconlith series are well developed. The return was made along the route followed by the old Seymour trail, all signs of which are now completely obliterated. Considerable difficulty was experienced in getting the pack-horses across the mouth of Adams River, owing to the extreme high water.

"The season was fully a month later than usual at an altitude of less than 6,000 feet. On the 1st of August about one-half the ground was still snow-covered, and even on the sunny exposures the horses could find scarcely any grass.

"From a point opposite the first island on Adams Lake, four miles from the outlet, a low pass, extends westward to Louis Creek, the summit of which is only about 3,000 feet above sea level. Throughout this valley there is a good deal of rich land which, unless some exceptional climatic conditions exist, would be very suitable for cultivation.

"From Cin'-max, a point on the stream flowing into Adams Lake at Skwa-am Bay, a traverse was made due north to the east fork of Barrière River. An isolated area of basalt, at a low elevation, was found on this route. On the east fork of the Barrière a lake not shown on any existing map was discovered. Its Indian name is Hum-ham-ilt and it proved to be seven miles long, with a low pass from its head running to Adams Lake.

"While in the neighbourhood an opportunity was afforded of visiting the coal mine on the North Thompson Indian Reserve. A tunnel running northward from the creek bed showed the following section:—

Coal.....	6 inches.
Sandstone.....	2 feet (variable.)
Coal.....	9 inches.
Sandstone.....	6 "
Coal.....	18 "

Besides these an underlying seam of coal is reported.

"About a week was spent in tracing the complicated outline of the Granite and Tertiary areas which are found interrupting and overlying the limestones and schists around the heads of Reservation and Edward creeks.

"It was found impracticable to take horses into the mountains of the Gold Range, so three or four weeks of the latter part of the season

were spent in those mountains on foot. The climbing was steep and difficult. Four main points were occupied for topographical sketches, besides several secondary ones. The rocks are gneisses and mica-schists, (probably Archæan) the latter holding garnets in many places.

"A careful examination was made of all exposures on the line of the Canadian Pacific Railway from Revelstoke to Salmon Arm for the purpose of getting a good section.

"A visit was paid to the Coal Hill mine, three miles south of Kamloops. An incline was being sunk along the dip of the seams, and in it the following section was seen:—

Coal.....	3 inches.
Shale.....	5 "
Coal.....	12 "
Clay.....	4 "
Coal.....	2 "
Shale.....	6 "
Coal.....	3 "
Shale and clay.....	5 "
Coal.....	5 "
Shale and sandstone.....	12 "
Coal.....	2½ "
Sandstone.....	8 "
Coal.....	3 "

The quantity of clay is variable and some of the shale partings are not continuous.

"Before returning the Glen iron mine on Kamloops Lake was visited. The ore is magnetite throughout, with a slight mixture of calcite and felspar in a few places, which, however, does not injure the ore for smelting. The following items were noted:—

"1. An opening a few feet from the railway, filling an irregular angular fissure from two to six feet in width.

"2. Three hundred feet south of last a deposit of four feet of good ore, with five feet mixed ore and country rock.

"3. Five hundred feet southward from last a large deposit of fourteen feet good ore, with ten feet of mixed.

"4. Thirty feet north-west of last, twelve feet ore.

"5. West of last a vein three feet thick.

"6. South-west of last numerous croppings of good ore undeveloped. At a low estimate ten per cent of the mass here is ore.

"7. North-east of No. 3 a vein four to ten feet thick. This is the principal source of output at present and is connected with the railway by an aerial tramway.

"All the veins run in an easterly and westerly direction, and are nearly vertical or dipping northward at high angles."

The cost of the season's work, including salary of assistant, was \$1,335.69. Since Mr. McEvoy's return from the field he has been occupied in completing the plotting, &c.

Mr. McConnell left Ottawa on the 27th of May with instructions to make an exploration in the Rocky Mountains to the North-west of Calgary, crossing either by way of the Howse or the Athabasca Pass to the Columbia to ascertain and define approximately the eastern limit, in that region of the northern extension of the great East and West Kootenay mineral bearing belt of crystalline rocks, which I had myself met with in 1871, at the head of Canoe Creek and in the vicinity of Tête Jaune Cache on the Fraser, at the western entrance to the Yellow Head Pass.*

On this work Mr. McConnell reports as follows:—"The party left Morley on the 9th of June, with six pack-horses carrying instruments, baggage and supplies for five weeks, but in addition to this, some Indians were engaged to pack 400 lbs. provisions as far as the Saskatchewan, so as to enable us to complete the survey through the Howse Pass without wasting part of the summer returning to the C. P. R. for fresh supplies. From Morley we travelled through the foot-hills to the Red Deer River which we crossed near the 'Gap,' and then entering the Rockies continued northwards by the longitudinal passes inside the first ranges. We reached the Saskatchewan at the Kootanie Plain on the 17th of June. From there we descended the Saskatchewan to the 'Gap,' and then worked westward to the summit. Mr. Russell making a paced survey up the valley, and a compass triangulation of the bordering mountains, supplemented by sketches from the various peaks climbed, while I collected data for a geological map and section.

"Before crossing the summit to the Blaeberry River a few days were spent round Glacier Lake, the source of one of the four branches which unite to form the Saskatchewan. Glacier Lake occupies the bottom of a deep valley bounded by high precipitous limestone mountains, and is about three miles long by a mile wide. A few miles above the head of the lake the valley is filled by the Great Saskatchewan Glacier, and two miles further on is terminated by a line of cliffs out of which the ice from the great river of the central range of the Rockies precipitates itself in ice cascades and avalanches. The glacier was

*Geol. Surv. of Canada, Progress Report, 1871-72.

ascended and such measurements of its size, rate of motion, &c., as time permitted were made.

"Leaving Glacier Lake we crossed the summit of the Howse Pass to the Blaeberry River and descended the latter to the Columbia, which we reached on the 1st of August. The Howse Pass has not been used for some years owing to the well-nigh impassable state of the trail caused by fallen timber, and much time was lost in cutting a passage through.

"The section through the Rocky Mountains cut by the Saskatchewan and Blaeberry rivers bears a general resemblance to that previously described along the Bow and Kicking Horse rivers,* but necessarily differs greatly in detail. In the eastern part of the range three great thrust faults due to pressure from the west were detected. The first of these occurs along the eastern boundary of the range, the second cuts through the Kootanie Plain, while the third and greatest, is situated immediately west of the continuation of the Saw-back range and has resulted in placing rocks of Middle Cambrian age over the Carboniferous. A notable feature of the Saskatchewan section is the almost complete absence of Cretaceous beds. Two bands of red sandstone which may possibly be of this age cross the valley, but the dark coal bearing shales which enter so largely into the composition of the ranges further to the south were not observed west of the 'Gap.' In the western part of the range the beds except in places have not been so violently disturbed as along the Kicking Horse. The Bow River series is nowhere brought to the surface and the mountains are composed of Castle Mountain, and more recent limestones and calc-schists often lying in great synclines and anticlines.

"After completing the traverse of the Howse Pass, we refitted at Donald, B.C., and then descended the Columbia valley to Kinbasket Lake. The packtrain was left some miles above the lake and the latter part of the journey made by water, as the old Moberly trail which we were following, owing to its long disuse had become so completely blocked with fallen trees that we were unable even with all hands chopping to clear more than a few hundred yards a day. The original intention was to descend the Columbia to Canoe River and then to recross the mountains by the Athabasca Pass, but this plan had to be abandoned owing to the length of time and heavy expenditure required to cut a trail down the valley.

"The geology of the Columbia valley proved to be extremely complicated and will only be briefly referred to here. On the south-west or

* Geol. Surv. Can., Ann. Rept., vol. II., part D, 1886.

Selkirk side of the valley, the rocks consist of mica schists and gneisses, probably to the Shuswap River of Dawson and Selkirk sections (Brit. Geol. Soc. Ann. vol. 2, p. 165). East of these but separated from them by a deep fault running parallel with the valley is a great thickness of quartzites, crushed conglomerates and argillites, representing the Bow River series. The latter are succeeded by the limestones of the Castle Mountain Group, the beds of which form the mountains bounding the valley on the north-east or Rocky Mountain side. Behind the first range of the Rockies the argillites and associated beds of the Bow River series are again arched by an anticlinal and extend north-westward in a gradually widening band from below Bush River to the Athabasca Pass and beyond.

"Coarse gold has been found in the beds of several of the streams heading in the band of Bow River rocks, and it is highly probable that paying placer deposits will eventually be discovered in this part of the range. The impassable state of the trails has hitherto prevented much prospecting being done. The schists of the Shuswap rivers on the Selkirk side of the valley are also metalliferous. A lode of galena was discovered during the present exploration, west of Kinbasket Lake, a specimen of which has been analysed in the Survey laboratory and is reported by Mr. Hoffmann to contain 26.25 ounces of silver to the ton.

"Work was discontinued on the 20th of September, somewhat earlier than usual, owing to a heavy snow-storm in the mountains rendering further climbing impossible. The outfit was brought back to Golden on the 23rd and shipped by the Canadian Pacific Railway to Morley, where it was stored for the winter. The horses were left at the same place, in charge of R. McFarlane. Cost of season's exploration, including purchase of pack-train, \$2,443.62."

In the beginning of April, Mr. Tyrrell was requested to prepare for an exploration in the country lying north of the Churchill River, and south of Athabasca Lake and Bear River. The region explored (an area of about 40,000 square miles) is remote from all ordinary routes, no reports or descriptions of it have been published, and the greater portion of it has never been travelled over by white men, not even by officers of the Hudson's Bay Company. Mr. Dowling accompanied Mr. Tyrrell, in the capacity of assistant, but worked to a great extent independently, and on different routes. Mr. Tyrrell summarizes the season's work as follows:—

"It was impossible to decide with any degree of certainty on the most advantageous starting point for the exploration, but

after a careful examination of the maps of the surrounding country, and Mr. Cochrane's unpublished traverse, made in 1882, of Reindeer and Athabasca lakes and Black River it was decided, with your approval, to send Mr. Dowling northward from Edmonton down the Athabasca River with the boat that had been used on Lake Winnipeg for the last two years, while I should proceed from Prince Albert by Green Lake to Isle à la Crosse, and push northward in canoes from there through the unknown country. The experience of the summer proved that this arrangement was the best that could have been made.

"We left Ottawa on the 6th of June and proceeded to Winnipeg, where C. C. Chipman, Esq., Commissioner of the Hudson's Bay Company, kindly gave us letters to the officers at all the northern trading posts, instructing them to furnish us with all necessary supplies. On June 13th we left Winnipeg by the train for the west, Mr. Dowling being instructed to go by rail to Edmonton, thence to drive north to Athabasca Landing, where he would find James Collins, whom I had sent from Selkirk with the boat, to descend the Athabasca River and survey the south shore of Athabasca, and the streams flowing into it, as far east as Fort Fond du Lac, where he was to meet me not later than the 1st of August, bringing with him supplies for the remainder of the season. I went west as far as Regina and thence northward on the Qu'Appelle, Long Lake and Saskatchewan Railway to Prince Albert.

"At Prince Albert a light wagon was hired, and on the 17th of June, with one man (Herbert Porter) and a teamster, we crossed the Saskatchewan, and entered a ridge of sand hills wooded with Banksian pine. The trail winds over and among these hills to beyond the crossing of Shell River, where it enters an almost level or very gently rolling country, with rich dark soil, wooded with groves of poplar varied with prairie glades. On account of almost constant rains the travel through these rich poplar woods was very heavy, and it was with much pleasure that we again reached Shell River, at a distance of about thirty miles from Prince Albert, where it winds in a narrow channel through the bottom land of a wide, sloping valley like that of the Saskatchewan. Beautiful gravel plains and terraces extend along the sides of this valley, and these are followed by the trail for the next forty or fifty miles, making one of the most beautiful roads in the North-west Territories.

"The valley is at first occupied by Shell River, or a branch of it called Snake Creek, while further north it is occupied by Sandy Lake, Devil's Lake and Whitefish Lake, and is crossed by Big River and also by a branch of Shell River. It was not traced to its northern

extremity, but it appeared to originate in a conspicuous ridge of boulder-covered, morainic hills which forms the main watershed between the waters flowing into the Saskatchewan and those flowing into the Churchill.

"Shortly before reaching these hills the trail leaves the valley, where its sides are 150 feet high, and enters the morainic hills, which are wooded with large white spruce. Crossing the hills, the trail descends to a gravel plain, and, again turning westward, it plunges into the deep valley of the upper part of Big River. The sides of this valley, through the bottom of which winds a small stream, appear to be composed of dark Cretaceous shales, and are bordered by several beautiful terraces, on which the trail has been located. This valley gradually decreases in depth as it is ascended till it appears to terminate in an extensive tamarack swamp. Here the trail leaves it and crosses an extensive plain underlaid by a sandy clay with boulders. On crossing this plain we entered another wide stretch of sand hills, beyond which is a level clay country, wooded with poplar, extending to Green Lake.

"At the south end of Green Lake the Hudson's Bay Company have a storehouse. On reaching here, on the 21st of June, we found that Mr. Gwillim had arrived with our two Peterborough canoes several days before. We also here found Mr. Moberly, the Hudson's Bay Company's officer in charge at Isle à la Crosse. He had come thus far southward to superintend the distribution of their freight. Having made the necessary arrangements with him we launched our canoes and started northward on Green Lake.

"This lake is a long, narrow body of water occupying the bottom of an ancient valley cut in the face of an easy slope.

"A survey of Green Lake was made with a compass and boat log, and then an estimated track survey of Beaver River down to its mouth in Isle à la Crosse Lake. In its upper portion the banks are stratified post-glacial deposits, while at the rapids the stream has cut into the underlying till, which contains many striated boulders. No rock in place was seen on Beaver River until the foot of the rapids was reached, just above the mouth of Doré River, where high banks of soft stratified sand are cut out of the Dakota formation.

"At Isle à la Crosse, Pierre Girard, a half-breed, and Ithingo and Hedderly, two Chipewyan Indians were engaged.

"On the 29th of June we descended Churchill River to the mouth of Mudjatick or Cariboo River. This latter stream was found to be at its extreme high water stage, but we turned into it, and began to stem its rapid current. The banks were overhung with willows into which the

water had spread from the swollen stream, so that it was impossible to track the canoes with a line and the depth of the water and the bottom of soft quicksand prevented the use of poles, so that we were obliged to ascend entirely with the paddle.

"The river winds from side to side of a wide sandy plain in the bottom of a sloping valley, the sides of which are composed of ridges of well banded red gneiss. The stream very rarely reaches the bases of these ridges and no rocky barriers obstruct its course, the few heavy rapids met with being caused by accumulations of boulders in the channel. The source of the river is in a series of small lakes lying in depressions in a sandy plain, on the height of land and not among rocky hills as might have been expected. Crossing this sandy height of land by several portages, a small lake is reached which discharges its crystal waters northward by a winding stream that flows at first through the above mentioned sandy tract, and then through an area of gneiss hills into the southern end of Cree Lake.

"This large lake, about fifty miles in length, lies a short distance north of and but little below the height of land. The southern end is surrounded by rocky hills of Archæan gneiss, while further north the islands and the west shore, which were the only parts visited, were found to be underlaid by horizontally stratified white or light red Palæozoic sandstone of the same age as that south of Lake Athabasca. Thus this lake adds one more to the number of the great lakes in Canada that lie along the line of contact of the Palæozoic and Archæan. Both Athabasca and Wollaston lakes occupy similar positions.

"In the central portion of Cree Lake are a great number of oval islands, composed of till and boulders, all lying with their long axes parallel to the direction of glacial striation. These islands in some cases rise to a height of 175 feet, while the water near them was found to be about seventy-five feet deep. They are of the character of those hills known to glacialists as drumlins.

"Cree River flows out of a bay at the north end of Cree Lake. It is a wild, impetuous stream, with only a shallow channel and no distinctive valley. It flows generally over a bed of angular masses of coarse whitish sandstone, which everywhere forms the country rock. The rock itself is but seldom seen, and the many dangerous rapids are caused by the presence of these broken angular masses of sandstone, as well as by sudden contractions and expansions of the channel. The river has every appearance of being very new, and the whole country shows abundant evidence of having been only slightly modified by meteoric or fluvial agencies.

"The descent of Cree River was accomplished in three days, Wapata Lake, into which it flows, being entered in the evening of the third day. A survey was made of this lake, and of the shores of Black Lake as far north as its discharge into Black River.

"In order to obtain supplies for the remainder of the season I was obliged to proceed hence westward to Fond du Lac, on the north shore of Lake Athabasca.

"One canoe with two men, and all the supplies on hand were accordingly left here, and with a light canoe and three men I started westward across the portage, about three miles and a half in length, which it is necessary to make in order to pass a series of heavy rapids and falls on Cree River. After crossing a small lake another portage two miles and a half in length had to be crossed before the easy water of the lower portion of Black River was reached. The total descent of the river in rapids and falls avoided by these two portages is about 300 feet, or at least this may be taken as the altitude of Black Lake above Lake Athabasca. From the lower end of the latter portage we descended Black River and followed the long straight narrow arm of Lake Athabasca westward to the Hudson's Bay Company's Post of Fond du Lac. Both the river and lake occupy the bottom of a great valley which extends along the line of contact of the altered Archæan rocks and the overlying unaltered sandstones. To the south stands the high and almost unbroken sandstone escarpment, while to the north rise high rounded hills of reddish grey gneiss, or lofty crags and precipices of dark green trap.

"This trap is found most largely developed along the north side of Black River, and all along the north-west side of Black Lake, where it appears to be running off into the country towards the north-east. It is very similar in character to many of the green Huronian rocks at Sudbury, Lake of the Woods, &c., and future investigation may show it to contain minerals of economic value. On the west side of Black Lake, and perhaps associated with this trap, is a low exposure of green chloritic schists apparently of clastic origin.

"We arrived at Fond du Lac on the evening of the 27th of July, where we were welcomed by Joseph Mercredi, a venerable old half-breed who had been in charge of the Hudson's Bay Company's post at this point for the past forty-seven years. He informed me that part of my supplies, and an old canoe previously used by Mr. McConnell, had already arrived.

"On the following day Mr. Dowling arrived from Fort Chipewyan having completed the survey of the south shore of Lake Athabasca. He brought word that the Athabasca River steamer would leave

on her last trip up the river about the 7th of August, and as the specimens already collected could not be carried with us during the remainder of our journey it was necessary, if they were to reach Ottawa this year, to send them at once to Chipewyan. A canoe and two men were therefore employed and sent off at once with the collections made up to that time.

"Afterwards we set to work to stow all our goods in our two canoes and leaving the boat to be sent back to Fort Chipewyan, we again started eastward on the morning of July 30. Mr. Dowling continuing the log survey of the south side of this arm of the lake, while I made a similar survey of the north shore, to the mouth of Black River. From this point to Wollaston Lake Mr. Dowling, as stated in his report, made a survey with compass and micrometer of all the rivers and smaller lakes, while the larger lakes were surveyed with a Massey boat log.

"A band of Indians had been induced to wait for us at the long portages, and a few miles before reaching them, Ithingo, one of our Indians from Isle à la Crosse, was sent by land to apprise them of our approach. With their assistance the two canoes and their heavy loads were carried across both portages in a day, and early in the evening we camped on the shore of Black Lake near the head of the western portage, where the two men had been left ten days before. Here the three canoes were loaded and bidding good-bye to our Indian friends we continued eastward, Mr. Dowling taking the south shore, while Mr. Tyrrell followed the north side of the lake, which was at first found to consist of high cliffs of dark green trap, and then of low lying rounded bosses of red granite.

"This granite extends up Black River above the lake to near the mouth of Porcupine River, where it runs off to the north-east, and the horizontal sandstone again makes its appearance. The river continues in this sandstone until near Little Hatchet Lake, its course being generally governed by the directions of the great drumlins or hills of unstratified sand and boulders, which rise on every side. Both the north and south shores of Little Hatchet Lake were surveyed, and on the 18th of August we entered Wollaston Lake, after a very laborious journey up a stream obstructed by heavy rapids, in which the men had constantly to wade in the water up to their waists, surrounded by ever-present swarms of noxious black flies.

"The west shore of Wollaston Lake was surveyed down to the mouth of Drifting River, near which we met a little band of Indians from whom we fortunately obtained a small additional supply of tea and ammunition. We had hoped to have also obtained from them some

information about the country to the south-west, but they knew nothing of it, except that formerly there was a canoe route up Geikie River, and across the height of land to Churchill. This route had not been travelled for a long time, and the portages would probably be all blocked with fallen timber if they could be found at all. Besides this our stock of provisions would last for very little more than a week longer. However, it was important that a survey should be made across this portion of the country if possible, and the three men from Isle à la Crosse were willing to try to get through it with me.

"The party was accordingly divided, Mr. Dowling was sent with two canoes and four men with instructions to survey the south shore of Wollaston Lake, thence to proceed by either the southern or northern route, as would be found advisable, to Reindeer Lake, to continue his instrumental survey through that lake, down Reindeer River and up Churchill River to Stanley Mission, connecting with Mr. Fawcett's survey of the Churchill River at Frog Portage. From Stanley he was to turn southward through streams and lakes to Montreal Lake, whence he was to proceed overland to Prince Albert. If possible an instrumental survey was to be made throughout, the streams being measured with a micrometer, and the lakes with Massey's patent log.

"The writer took one canoe and three men, and on the 25th August began the ascent of Geikie River. The country through which this river flows consists of evenly banded red granite gneiss, with a regular and very persistent strike in a south-westerly direction, arranged in long ridges, parallel to the strike, which are separated by more or less wide intervening valleys. The lower portion was easy of ascent, as it consisted of a series of narrow lakes connected by rapid, but not impassable, stretches of river, but in its upper part the difficulties became much greater, for the stream breaks up into a number of small branches in which there was hardly enough water to float the canoes. Ascending one of these branches to its source we crossed from one lake to another over old and obscure portages, which we were obliged to cut out anew, till we came to Little Whitefish Lake and thence descended an irregular stream to a large lake known as Whitefish Lake, where we arrived on the 9th of September. Our provisions would have been long since exhausted had not a moose and four bears been added to our stock on the way. Wild fowl of any kind were very scarce.

"My Indian canoemen recognized Whitefish Lake as a place which they had previously visited, and, as they had descended Whitefish River from the lake to Churchill River, uncertainty as to our route was now at an end, and though the river ahead of us was broken by many dangerous rapids, the proper channel and all the portages were

known, and we hailed with delight the finding of a route which we could follow with the assurance of finally reaching our desired destination. The survey was continued across Whitefish Lake and down Whitefish River to Churchill River, where it was connected with Mr. Fawcett's micrometer survey of the latter stream. All the way from Wollaston Lake a very careful survey had been kept. The bearings were taken with a prismatic compass, checked daily by readings on the sun near its rising or setting. As there was no sign of local attraction, these may be considered as being fairly accurate. The lakes and quiet reaches were measured with a patent log, while the lengths of the stretches of flowing water were estimated. Observations for latitude were taken as often as possible, sometimes twice daily, and thus the positions of most of the natural features observed were obtained within a comparatively small limit of error. Similar observations for latitude were taken at many other points during the course of the summer.

"From the mouth of Whitefish River we followed the Churchill River upwards, examining the various rock exposures, and living on what ducks we could shoot from time to time, for our stock of provisions had been exhausted some time before. On the evening of September 20th we arrived at Isle à la Crosse, just as a heavy equinoctial storm began to set in.

"Here the men were paid off and my canoe was left for the winter, and while the storm raged without, two days were spent very pleasantly with Mr. H. J. Moberly, the Hudson's Bay Company's officer in charge of that district. Arrangements were then made with Mr. Moberly for a passage out to Prince Albert, and leaving the pleasant friends at Isle à la Crosse on the 24th of September, I was taken up Beaver River to Green Lake in three days, and pushing onward, Prince Albert was reached on the evening of the 2nd of October.

"As Mr. Dowling, and the men with him had not yet arrived from Montreal Lake, I determined to spend a few days in this vicinity. The underlying rock here was found to be a soft dark gray clay shale similar to the Pierre shale of Manitoba and the Upper Saskatchewan, but no fossils were discovered in it, so that its exact age could not be certainly determined.

"A short distance below the town a high steep cut bank runs along the north side of the river, and near its west end a slide has carried down a large section of the bank. The cliff is composed above of about twenty feet of stratified sand, through which chalybeate springs are issuing here and there, after cementing the sand in their vicinity into a hard red sandstone. The bottom of the cliff is a soft gray non-calcareous Cretaceous shale.

"On digging into the slide above mentioned, and after passing through a mass of loosely arranged slidden sand, we reached some beautifully stratified sand standing at a high angle. It looked like an old bar or point beside the river, on top of which the bank has slidden, but the false-bedding (if such it be) is very steep, and it is just possible that it may be a portion of the bank, slidden and tilted, but not otherwise disturbed. This sand is composed of grains of quartz in layers, interbedded with layers of fragments of black lignite, the latter occasionally in well rounded pebbles an inch or more in diameter. There is a great quantity of this lignite, the bed of sand, whose thickness could not then be determined, being often composed largely of it.

"These rounded grains and pebbles of lignite have clearly been washed some distance by the water, and deposited alternately with the heavier quartz grains as the current varied in strength, but the quantity present would seem to be too great to permit of its having been washed from any of the known coal seams on the river, the lowest of which is near the mouth of Egg Creek, 400 miles higher up the stream. It is much more likely that these fragments of lignite have been washed from a deposit, not at any great distance, which is now covered.

"In order to determine whether such a deposit of coal exists in the vicinity or not, also whether the Dakota sandstone is here tabearing or not, as well as to ascertain the exact nature of the Cretaceous section in this district, where the surface appears to be almost everywhere covered with drift, it would be of the greatest service to make a boring down to the underlying Palæozoic rocks. If either coal or oil were met with the value of the country would be enhanced to many times the cost of the boring. A careful log, with specimens of the drillings from every five feet, should be kept, so that even if nothing of immediate importance were struck, the scientific information obtained would be of great interest. This part of the country has not yet been thoroughly examined, and it is therefore impossible to say whether a complete geological section of the underlying rocks can be obtained from natural exposures, but the overlying glacial and post-glacial deposits appear to be so continuous that it is highly improbable that such a section can be obtained without boring.

"Following the river downwards below Prince Albert, it is found to flow in a gradually deepening valley until in section 36, township 48 range 24, near the head of the rapids, the sides are sloping and composed of dark gray clay, like that weathered from the Pierre shales. The country to the south of here is undulating, with a soil of a gray slightly sandy clay without boulders.

"The bank of the channel is a soft dark gray clay with now and then a few boulders on the points. Occasionally there is an appearance of dark gray shale which may be a true outcrop of the Pierre formation. Half a mile lower down, the river cuts into the south side of the valley, and expose partially bare cliffs of dark gray unstratified clay or till with pebbles and a few boulders, overlaid by irregularly stratified clay. About half of the boulders and a third of the pebbles both here and on the points are of reddish and light yellow Palæozoic limestone, a very few are of Niagara shale, the rest being fine and coarse granite, &c. Almost all the boulders, and a great number of the pebbles are beautifully polished and striated.

"Proceeding eastward, on the south side of the valley, the trail crosses a ridge of sandy hills wooded with pine and poplar, representing the sand dunes on an old shore line, and then strikes out on a wide level plain, through which both branches of the Saskatchewan flow in deep channels with high scarped banks.

"Two miles above the Forks the sides of the valley of the North Branch are about 160 feet high, and show at the top two feet of rounded gravel, below which is about thirty feet of hard unstratified till, with pebbles and a few boulders. Below this the banks, where seen, are covered with slides, but as springs are issuing from beneath the till, it is probable that porous, stratified, inter- or pre-glacial deposits are there present. The boulders are of gneiss, red and yellow Palæozoic limestone, Cretaceous sandstones, etc., and many are beautifully striated.

"At the Forks, the high banks, as far as could be seen, are covered with slides of loose sand.

"Up the South Branch the trail from the Forks crosses the thinly wooded plain for about three miles, ascends a low ridge of sand hills, representing sand spits and dunes on an old shore line, runs over a moderately level country, and for about five miles over a more prominent ridge of sand hills wooded with pine, etc., and across an undulating country to Prince Albert.

"I left Prince Albert on the 7th of October, and remaining one day in Winnipeg to settle accounts with the Hudson's Bay Company, arrived in Ottawa on the 15th of October.

"A large number of specimens were collected, typical of the different classes of rocks met with.

"Between two and three hundred photographs were taken of different features of interest, but unfortunately, many of them, having been taken on defective negative films, were not good."

Mr. Dowling left Ottawa on the 8th of June, and reached Edmonton on the evening of the sixteenth. Here a boatman familiar with the rapids of the Athabasca was engaged. A sailor engaged at Selkirk, had been sent on in advance, with a small sailboat used by Mr. Tyrrell, on Lake Winnipeg, in 1891, and had arrived at Edmonton. The journey to Athabasca Landing was made by wagon, and on the 24th of June the party commenced the descent of the Athabasca. At Fort McMurray, 260 miles below, a canoe was secured, with which to ascend and examine the smaller streams flowing into the Athabasca River and Lake from the east and south. Mr. Dowling further reports on the work as follows:—

“The first river ascended was the Firebag, a small stream rising in a range of hills to the east of Fort McMurray, and joining the Athabasca about eighty miles below. This river in its lowest course cuts a deep valley through the lacustral deposits which form a wide belt bordering the southern shore of Lake Athabasca. Several exposures of the underlying rocks are seen; the first few are of the light coloured Devonian limestone, similar to that exposed on the Athabasca. Further up at the forks of the stream the limestone is followed by the black sandstone holding tar, but this is here represented by beds only a few feet thick, so that it probably does not extend much further to the east.

“This section of the later deposits consists of about ninety feet of stratified sand overlying beds of fine dark clay fifty feet thick. The bedding of the sand is accentuated by a liberal staining of occasional beds by tar. The surface of the country is generally undulating, the soil is principally sand with very little loam, so that it supports only a scanty growth of pines. This sandy country, or sandy plain, was found to stretch all along the south side of the lake and past the Beaver River.

“After calling at Fort Chipewyan, the southern shore of the lake was followed to the east end, and a survey of it was made with compass and boat log.

“The streams examined were the Old Fort River and the William River. The former was found to be perhaps the larger, though the William River has a larger channel, and evidently in the spring is a fair sized river. Both cut through the sand beds to the underlying rock, which was in both cases of a hard reddish or brownish sandstone. The low water in the William River compelled us to leave the canoe and travel across country in order to examine the part of the river above the rapids. About fifteen miles of bare sand plains were crossed before we came into the scrub pine country again. The

country here is more undulating, and the river is said to rise far to the south in the Muskeg Mountains.

"The general character of the southern shore of the lake is monotonous, mostly sand beach, varied occasionally by boulder points. Ledges of sandstone appear in two or three places, but the shore is generally backed by cliffs of sand. Behind, the country rises rapidly, and is covered with a light growth of small Banksian pines. There are a few spruce and birch in the valleys of the small streams and on a narrow strip along the lake shore.

"The turbid waters of the Athabasca, entering the western part of the lake, colour the lake water to the eastward. On the 20th of July this extended fifty miles eastward from the mouth of the river. Beyond this the lake water was clear, blue and cold, the surface temperature being 47° F. On July the 28th we reached Fond du Lac (Hudson Bay Company's trading post) a few hours after Mr. Tyrrell.

"The log survey was continued eastward, and the end of the lake was reached on the evening of the 1st of August. Thence, on the river portion of the route, the distances were measured by the micrometer. A micrometer survey was made of Black River to Black Lake, and then a log traverse of Black Lake to the mouth of Hatchet River. The micrometer survey was continued up the Hatchet River to Hatchet or Wollaston Lake. The western and southern shores of this lake were traversed by log and compass, and the shores and islands delineated as well as the limited time would allow.

"We decided on trying the southern route to Reindeer Lake by the Swan River. A survey, by pacing the portages and measuring the lakes crossed by the log, was carried to the Swan River. This portion of the route consists of eight portages, from the south-eastern shore of Hatchet Lake *viâ* a chain of small lakes to the head of a small stream running east to Reindeer Lake. This stream proved so shallow that all our efforts were needed in getting down, and the micrometer survey had to be abandoned. An estimated traverse was, however, made to the lake, where we arrived on September the 2nd. A log traverse was made to Lac du Brochet Post, at the north end of this lake. Supplies were obtained, and we returned by the eastern shore to Porcupine Point, and crossed to Vermilion Point. The western shore was followed to the outlet of the lake. The shores and islands of the southern half of the lake are high and rocky. The banks are generally steep, with scarcely any timber. Many of the islands are a mass of gneiss rock, rounded by glacial action, capped by a slight covering of moss and a few small spruce trees.

"The rocks of the northern part are chiefly a coarse dark gneiss. Towards the south bands of finer grained gneiss and mica schist are seen, cut often by dykes of a light red intrusive granite. The direction of striation on the rocks at Reindeer Lake have an average course to the south 10° to 20° west magnetic. The northern limit of poplar occurs about thirty-five miles up the lake. On Deer River, however, the poplar is quite plentiful showing a great change in a few miles. Small shrubs such as the wild cherry and saskatoon berry were noticed with the poplar; the fruit on these was fully ripened and quite dried up on the 21st of September.

"A micrometer survey was made of Deer River to its junction with the Churchill, then of that part of the Churchill between the mouth of Deer River and the Frog Portage where it was concluded on the 21st of September. Intending to reach Prince Albert *via* Montreal Lake we turned westward up the Churchill to Stanley Mission or Rapid River, H. B. C. Trading Post. Two miles to the westward a chain of lakes and portages leads to Lac La Ronde at a level of thirty or forty feet above the Churchill River. This lake is situated in the Archæan area; it is of the same character as those to the north, irregular in outline, and dotted with many islands, especially along the western shore. Our course across it lay in the midst of a chain of islands following the strike of the rock which is principally a spotted gneiss. To the west we passed the mouths of several bays in one of which the Indians obtain a soft serpentine from which they manufacture their pipes. Leaving the lake we passed into the drift covered area and saw no more of the Archæan. Among the boulders on the shore of Big Stone Lake some pieces of a light coloured limestone were noticed, and on inquiry I was assured that this limestone occurred in place all along the extreme southern shore of Lac La Ronde.

"Montreal Lake is only a shallow basin about thirty miles long and from five to ten miles wide, situated on a sandy terrace on the northern flank of Montreal Mountain. The outlet is by a small stream flowing north eastward; it cuts through the edge of the terrace and shows a section of sixty feet of stratified sand. Northward the stream flows through several small lakes and generally low country to the southwest corner of Lac La Ronde. The timber in the rocky country bordered by the southern shore of Lac La Ronde is not large or abundant. Southward there is some improvement and large individual spruce trees occur occasionally. The "Lob sticks" at Big Stone, Hudson Bay Company Post, are fine examples of these. On the Montreal River, small Banksian pine cover the eastern slope of the sandy plateau through which the river cuts. No large timber, spruce or pine, is seen till near the lake where, at the southern end, some

groves of large spruce were seen. Montreal Mountain appears to be more than half burnt over. The largest timber seen is on the watershed south of Montreal and Deer lakes. Here the formation of the country is evidently morainic—very rough irregular hills with many boulders. Southward the country slopes gently towards the Saskatchewan. At Montreal Lake, a wagon was hired to carry our baggage to Prince Albert where we arrived on the 12th of October.”

After paying the men and storing the outfit Mr. Dowling left for Ottawa and arrived there on the 18th of October.

Cost of season's exploration, Messrs. Tyrrell and Dowling, \$3,430.68.

Mr. McInnes left Ottawa on the 9th of June, with instructions to make such surveys and examinations as were required to if possible complete the work on sheet No. 9 of the Ontario series. This sheet adjoins sheet 6 to the east and sheet 8 to the north. It covers an equal area of 3,456 square miles and includes Lac des Mille Lacs and Dog Lake. A large part of the area is unsurveyed and therefore much time was occupied in surveying lakes and rivers. Mr. F. B. Cushing, B.A., of Montreal, and Mr. W. P. Bull, of Toronto, joined the party at Port Arthur as assistants, and Savanne station, seventy miles west of Port Arthur, on the Canadian Pacific Railway, was reached on the 15th of June.

“Lac des Mille Lacs presents a very irregular outline and a large number of islands. The southern edge of the great gneiss area, which occupies the whole of the northern part of the lake and extends northwards beyond the Canadian Pacific Railway track, can be traced along the whole length of the lake from east to west. The contact of the Laurentian gneiss with the Huronian, though generally well marked, is sometimes difficult to define closely, the rocks over a belt of a mile or more in width partaking of the macroscopic character of both series, and only at points widely separated, ranging themselves with one series or the other. Though not apparently the contact of an intrusive mass with sedimentary strata, it shows in certain places many of the phenomena of such a contact, though one series occupies the apparent position of the intrusive as frequently as the other, and each in places incloses blocks of the other and sends off into it long arms or apophyses. The best explanation seems to be that both sets of rocks by the combined effect of heat and pressure, exerted probably at a great depth, have been rendered in places viscous (local conditions determining in each case which remained stable) and so each bears to the other the apparent relation in places of an intrusive mass.

“Three weeks were spent in an examination of the country lying to the south of Greenwater Lake. A series of lakes which lie between the

south-west end of upper Shebandowan Lake and Waykwabionan Lake was examined and found to be wholly within the gneiss area which further south forms the Giant Range, the Huronian belt of Shebandowan extending only a little over two miles to the south of Shebandowan. A micrometer survey was carried north-westwards by the Matawin River and another chain of lakes to Greenwood Lake, and here again only gneiss was found until the iron-bearing belt of Greenwater Lake was struck about a mile south of that lake. The gneiss area of Northern Light Lake was thus shown to extend continuously northwards to the northern shore of Greenwater Lake, which takes its markedly circular form from the northern edge of this gneiss area.

"In order to gain a knowledge of the country lying to the north of the railway, a trip was made from English River by way of Wawung and Pakeeshkon lakes to Muskeg Lake, and thence to Savannb River at Linkoping station on the Canadian Pacific Railway.

"With the exception of a narrow belt of Keewatin green schists which crosses English River, about twelve miles or thereabouts below the crossing of the railway and strikes for a short distance with the general course of the river, Archæan gneisses occupy the whole of the country traversed. The route lay through a series of lakes, the largest of which Pakeeshkon (or Cedar Narrows) Lake lies about twenty-five miles north of Upsala station, on the Canadian Pacific Railway. It is about fifteen miles long, and has an average width of from three miles to half a mile; its discharge flows westerly into English River. The country traversed is generally low, with no hills which rise more than 100 or 150 feet above the general level. Muskegs cover a large part of the surface; the forest growth is of small size, and consists mainly of black spruce, Banksian pine and poplar. That the land, in favourable spots, is capable of cultivation, is shown by the fact that the Indians encamped at Muskeg Lake, on the 31st of August, had had potatoes, which they had grown there, of good size and quality.

"A week was spent in a trip to the western end of Gunflint Lake where are exposed beds which are probably near the base of the Animikie, and which show interstratified beds of iron ore. Although a number of boulders showed fairly good ore, all that were seen in place were very much banded with cherty material. These banded cherty and jaspery beds occupy an almost horizontal position on the top of the upturned Archæan gneisses and schists.

"Three hundred miles were surveyed by micrometer and compass, and about 100 miles by compass and estimated distances.

"The cost of season's work was \$1,275.86."

Mr. Smith left Ottawa for the field on the 7th of June, with instructions to continue the work of the preceding season in the country to the north-west of Thunder Bay. Three days were spent at Sudbury to examine, for the purpose of comparison, the contact there of the Laurentian and Huronian systems, and also, some of the nickel ore deposits in that district. He then proceeded, *via* Sault Ste. Marie, to Port Arthur, where he arrived on the 13th of June. Here, he was met by Mr. W. W. Leach, of McGill College, Montreal, who had been appointed his assistant for the season.

Mr. Leach proceeded to English River on the 15th of June and was joined there by Mr. Smith on the following day, and on the 17th, the party being completed, proceeded to Scotch Lake to explore a reported route from there to the Seine River. Nine days were spent in sketching and exploring fourteen small lakes south of Big Scotch Lake, but no practicable route to the Seine River was discovered.

On the 27th of June Mr. Smith returned to English River and was there engaged examining the rocks along the line of the Canadian Pacific Railway, east of that station and along the boundary line between the districts of Thunder Bay and Rainy River; he also corrected the topography of Pyramid Lake crossed by this line south of the railway. He explored the English River up its source as far as the northern boundary of the Seine River sheet (No. 6 of the series). During this time Mr. Leach endeavoured to trace a route said to exist between Little Scotch Lake and Brush Creek. He found the country impassable, but added several small lakes to the topography of the district.

On the 2nd of July Mr. Leach and two men were sent to Savanne, with instructions to cross Lac des Mille Lacs, and to meet Mr. Smith on the 5th of July, near the junction of the Fire Steel and Seine rivers; Mr. Smith, after procuring supplies from Rat Portage, proceeded to the rendez-vous by Hay Creek and the Fire Steel River for the purpose of examining the rocks on that route.

Mr. Leach did not reach the meeting place till the 7th of July, owing to a serious accident in one of the rapids of the Upper Seine River, in which the Peterboro' canoe was wrecked.

After mending the canoe sufficiently to carry the party back to Carlstad where they arrived on the ninth, Mr. Smith went to Rat Portage to replace the lost supplies and equipment, returning to Carlstad on the 11th of June.

The party then proceeded down the Fire Steel and Seine rivers, exploring some lakes, tributary to the latter on the way. Leaving the Seine River at the north end of Seine Lake on the 18th, they pro-

ceeded up a route partially surveyed by Mr. Wm. Lawson in 1890, in the hope of being able to find a way through to the lakes sketched in the first part of this season's work, and thus secure a continuous geological section.

Supplies for one week were taken, but owing to the extreme difficulty of the route, the connection through was not completed when the supplies failed, although ten small and medium sized lakes, with their connecting streams were surveyed with micrometer and compass.

The party then went back to Seine Lake, and thence proceeded through a route from this lake to Moose Lake (another expansion of the Seine River, further down its course), correcting the topography of the lakes on this route, by the townships base line surveyed by Mr. Nivens, P.L.S., in 1891. Through this route and down the Seine River expansions, to Steep Rock Lake the rocks were examined more critically and in localities not hitherto visited.

Below Steep Rock Lake the rocks of Beaver Lake, north of Seine River, were then examined. Leaving Mr. Leach on the 1st of August to endeavour to pass down the outlet of Beaver Lake, Mr. Smith proceeded down the Lower Seine River, examining the rocks *en route*, and thence across Rainy Lake.

In Shoal Lake and in Rat Root Bay of Rainy Lake, he examined the conglomerates and their associations for the purpose of comparing them with the Seine River conglomerates, which are in the same horizon as those of Shoal Lake, mapped on the Rainy Lake sheet (No. 3).

Mr. Smith arrived in Fort Francis on the 6th August and was followed a few hours afterwards by Mr. Leach who had found the outlet of Beaver Lake impassable.

Fresh supplies being procured at Fort Francis the party left on the 9th of August, and proceeded up Rainy Lake and the Manitou route in order to commence work on the Manitou sheet (No. 4 of the series).

They attempted to find a route from Lake Harris (west of Manitou Lake) to Lake Lawrence and thence to the Lake of the Woods, but failing in this, after traversing six small lakes they proceeded up the Manitou route across the Wabigon Lakes to Elm Bay near Barclay, on the Canadian Pacific Railway, arriving there on the 23rd of August.

Mr. Smith went to Rat Portage on the 24th, remaining till the 29th procuring supplies, visiting the mines on the Lake of the Woods and collecting mining statistics, while Mr. Leach made a log survey of the shore of Big Wabigon Lake.

The party then left Barclay and proceeded up the headwaters of the Little Wabigon River, and up those of the Big Turtle River, to within the limits of the Seine River sheet, when the final topographi.

cal and geological work necessary for the completion of this area was performed.

On the 17th the topographical work being completed Mr. Leach proceeded to the railway at English River, closing his season's work on the 22nd, while Mr. Smith advanced up the Seine and Atikokan rivers, obtaining geological sections over the township outlines surveyed by Mr. Nivens during the previous year.

Minute attention was given to the relations of the quartz-porphyrries to the surrounding Keewatin rocks, north of the Seine River and west of Steep Rock Lake, also to the relations of a disconnected area of similar quartz-phosphyrries to the rocks of the so-called Steep Rock series and to the Keewatin rocks south-east of Steep Rock Lake.

Round Lake was then connected by a micrometer and compass survey to the boundary line between the districts of Rainy River and Thunder Bay.

Mr. Smith then travelled to Savanne where he arrived on the 8th of October. After settling the business affairs of the season at Port Arthur on the 10th, he went to Toronto, to procure copies of the timber limits and mining location surveys recently made in the area embraced in the Seine River sheet.

He then went to Madoc, to examine the relations between the limestone and Archæan there for comparison with the limestones of the Steep Rock series. He closed the field work of the season at Madoc on the 18th of October and proceeded to Ottawa on the same day.

The work of the season was for the most part of a purely geological character, but considerable topographical detail was secured in hitherto unexplored areas.

The field work in the Seine River area is now completed, and all portions of it, believed to be accessible, have been examined.

The work was necessarily scattered, for supplying incomplete details, and re-examining critical localities, preparatory to writing the report and compiling the map.

A sketch of the geology of the district was given in the last Summary Report. The work of the season while adding to the accuracy and completeness of previous observations suggests no modification of this sketch necessary to record here.

No important discoveries of economic minerals were made, but Mr. Smith finds indications of iron ore bodies, in micaceous schists probably of Couchiching age, and in a lower geological horizon than they are usually looked for in this district. He finds that in his field the gold-bearing veins are associated almost invariably with quartz-porphyrries, which from the field evidence he is inclined to regard as the latest

important eruptives of the region. A few of these veins appear to be very rich, and in one of them an interesting association of silver-bearing minerals was observed.

Very little prospecting and no mining has been done in this area during the past season. Mining activity in the Lake of the Woods district has been seriously checked by the failure of the reduction works at Rat Portage, but at two or three of the gold mines work is still being carried on, and at the Sultana Mine, stamp mills are in course of erection.

Near Rat Portage and Keewatin some encouraging discoveries of nickeliferous ore have been made, but none of the specimens assayed show a high percentage of either nickel or copper. Discoveries of gold and also of non-titaniferous magnetic iron ore are reported from Rainy Lake.

The cost of the season's exploration was \$1,258.55. Since the foregoing was written Mr. Smith was attacked by an illness which I regret to record terminated fatally on the 19th of January. He had worked eight years on the Geological Survey and was a most painstaking and promising young geologist. This early and unexpected death is a serious loss to the Department.

Dr. Bell was requested to continue the survey and the necessary observations to complete, if possible, the sheet No. 125 of the Ontario series, Byng Inlet sheet. This sheet adjoins the Sudbury sheet No. 130, to the south, and embraces an area of about 1,800 square miles, including a portion of the Great Manitoulin Island. On the progress of this survey and on the other work of the past year Dr. Bell reports as follows:—

“After the close of the field operations of 1891, the winter months were occupied with office work in the usual way, which embraced reading proofs of the report on the Sudbury district, preparing appendices and attending to the illustrations for it, also correcting proofs of the geological map to accompany it, the preparation of a summary report for 1891, plotting the instrumental surveys which I had made during the summer and preparing other data for the map (sheet 126) on which the work of the season was to be represented. These data included the track-surveys and explorations made by the party and others, in various parts of the area covered by the sheet as well as numerous notes on geological and other observations. The adjustment of the surveys which had been made by others within the same area and the laying down of our geological notes. The specimens collected required to be carefully examined and considered in connection with the geological problems involved. The above formed the basis for work.

ing out the geology of the district which had been gone over during the summer, the solution of which was the ultimate object of the studies made during the winter. In addition to the summary report above referred to a fuller report on sheet 125, Byng Inlet sheet, was partially prepared, but it was found that before a satisfactory account of the geology of the whole area which it covers could be given, more field work would be required to be done. This has been attended to during the past summer and the necessary data have been obtained for completing the report. Besides the above principal duties of the winter months a certain amount of time was taken up in such minor matters as accounts in connection with field work, correspondence on Survey matters, answering inquiries for information, courtesies to visitors to the museum, and preparations for the following season's field-work, etc.

"With reference to the field work of 1892, the object aimed at was the completion of the geology of sheet 126, together with the making of some topographical and geological surveys required to complete sheet 125, and which will be more fully described further on. Sheet 126 embraces Grand Manitoulin Island, except the Indian reserve lying east of Manitowaning and South Bays, Cockburn Island and a strip of country along the main north shore of Lake Huron from Bay of Islands to a point west of Mississagi River, and it may be referred to for convenience as "the Manitoulin Sheet." The islands just named had been geologically surveyed by myself in 1865 and 1866 and some additional details were worked out on the first mentioned island in 1886. La Cloche Island and Peninsula had been examined geologically by the late Mr. Alexander Murray and myself in 1860, while in previous years Mr. Murray had explored the north shore and surveyed the Spanish and Whitefish rivers. It therefore only remained for me to complete the work in certain parts where it seemed defective.

"I was assisted by Mr. H. G. Skill, who had been with me during the two previous seasons, till the 27th of September, and by Mr. W. G. Miller, B.A., and Mr. R. W. Brock, both of whom had been with me in 1891 till the 7th of October. Mr. Miller having unfortunately poisoned his right hand was partially incapacitated during a portion of the season.

"Having determined to make Little Current my headquarters for the season, I left Ottawa on the 27th of June and arrived there on the 1st of July. The first few days were spent in working at the geology in the vicinity. On the 6th of the month Messrs. Miller and Brock were sent to work in that part of Manitoulin Island which lies between West Bay and Bayfield Sound. They were both fully informed as to what had already been done in that section and were each furnished with a

geologically coloured map of the region and were instructed to confine their attention to ascertaining, if possible, new facts in regard to certain formations and to tracing out their boundaries in greater detail.

"On the same day (6th July) I left Little Current with Mr. Skill in order to trace out geological boundaries in the part of the island which lies between West Bay and South Bay. We were favoured by fine weather and made rapid progress, returning to headquarters on the evening of the 12th, while Messrs. Miller and Brock got back on the 16th. The next three days were spent in repairing our canoes and visiting Strawberry Island and other localities in Manitowaning Bay.

"On the 20th I left Little Current in two canoes with my assistants and two other men for the purpose of making a micrometer and compass survey, and a geological examination, of the coast of Georgian Bay from the eastern mouth of French River to Byng Inlet, about twelve miles. Besides the geographical and geological additions to the map, which were to be derived from this work, it was intended to connect the hydrographic survey of this part of Georgian Bay with the surveys of the Crown Lands Department in the vicinity. As is well known, the north-east shore of Georgian Bay is fringed with a belt, several miles in width, of rocks and rocky islands, which are almost innumerable. The hydrographic surveys of the late Admiral Bayfield and of Commander Boulton, R.N., being intended for use from the deep-water stand-point, did not often penetrate far into this fringe of islands and rocks; while the Crown Lands surveys, having been made from the landward side, did not embrace many of these worthless rocks and islands. An intermediate zone was thus left unsurveyed, and therefore, in order to make a more complete and accurate map than had hitherto existed, it was necessary to survey this zone and to establish connections between fixed points in the two classes of surveys already made. My survey included Key Inlet (or "river") Henvey Inlet and part of Byng Inlet. I had made a geological reconnaissance of this coast in 1876 and reported the rocks to consist of common varieties of Laurentian gneiss. Additional geological facts were ascertained on the present occasion and considerable attention was given to the glacial phenomena, which present many points of interest in this part of the country.

"On our return to Little Current Messrs. Skill and Brock were sent with one man to make track surveys and cut out portages between the head of Narrow-Bay and Trout Lake to the north-east of it and also to make a new track-survey of Trout Lake and some geological explorations in its neighbourhood. In the meantime I examined some of the islands of the North Channel and a few days were spent on a trip to

Collingwood, during which Mr. Miller was left in charge of the camp on an island near La Cloche Post.

"On the 20th of August, or a few days after my return to this camp, Messrs. Skill and Brock returned from their work in the Trout Lake district. Some of the islands between Great Cloche Island and Clapper-ton Island were next examined and on the 24th of August we commenced a detailed instrumental survey of La Cloche Lake and a geological examination of its shores and of the surrounding country. This work occupied all the available weather till the end of this month.

"From the beginning of September till the 18th of the month the time of myself and assistants was taken up in the examination of the north shore and the islands of the North Channel from La Cloche Post to the western extremity of the sheet, with the exception of a few days, during which Mr. Skill with one man was engaged in making a track-survey of McKinnon Lake, east of La Cloche Lake, and an exploration of the intervening country.

"On the 19th of September we started, by way of Whitefish River, for the purpose of making further geological examinations of the country between Bay of Islands and Lake Panache and of the region to the southward of this lake. On the 27th we returned to Little Current, when Mr. Skill was paid off as he was then obliged to return to college.

"On the 28th of September I left Little Current by sail-boat to complete the geological examination of the western part of Manitoulin Island and after rounding the western extremity, I arrived back to the same place on the 6th of October, when Messrs. Miller and Brock were paid off on the 7th and they returned to Toronto in order to resume their college duties.

"From the 7th to the 17th of October was devoted to examining the shores and islands between Little Current and Killarney, employing two men and a sail-boat for this purpose. On the latter day, I left Killarney in a canoe with the same two men to work along the contact of the Laurentian and Huronian rocks to the northward of Collins' Inlet and returned to Little Current on the 30th. One of the two men who accompanied me on this journey was paid off on the 1st and the other on the 4th of November. The remainder of my time, before leaving for Ottawa, was spent in geological work in the neighbourhood of Shigguandah and on the north shore of Bay of Islands, in labelling and packing the specimens collected during the summer and in other duties in connection with the closing of the season's work, and I arrived in Ottawa on the 24th of November. Total cost of season's operations \$1,587.27."

The detailed report on the structural and economic geology will be prepared, to accompany the map.

Mr. A.E. Barlow was engaged in carrying on the work necessary for the completion of sheet No. 131 of the Ontario series of geological maps. This sheet adjoins the Sudbury sheet, No. 130, to the east. It covers a similar area of 3,456 square miles between latitude $46^{\circ} 13' 20''$ and $46^{\circ} 55' 07''$ north, and longitude $78^{\circ} 51' 37''$ and $80^{\circ} 22' 35''$ extending from near Eau Claire station to a little beyond Warren station on the Canadian Pacific Railway. It includes nearly the whole of Lake Nipissing and the southern portions of Lakes Temagami, Temiscaming and Keepawa. Another season will be required before the work necessary for the completion of this sheet will be finished. Mr. Barlow was assisted by Mr. J. T. E. Johnston of this department, who was mainly engaged in a survey of the roads. Mr. Barlow reports as follows :—

“ Leaving Ottawa on the 8th of June, a few days were spent at Sudbury collecting information with regard to the working of the nickel mines and obtaining some necessary supplies and equipment. A careful micrometer survey of the western end of Lake Nipissing was made from Cache Bay on the north to Frank Bay on the south side, in the township of Patterson. The shores and islands, which latter are here exceedingly numerous, were carefully delineated and connection made on the west arm with the survey made for the Sudbury sheet. The northern shore of this lake was also examined and also the routes from Lake Nipissing *via* Trout Lake and Nosbonsing Lake and the Mattawa River to the Ottawa. Continuing up the Ottawa to the Long Sault, another micrometer survey was made of Obashing Lake (sometimes wrongly spelled Beauchine) and the route from this to Keepawa Lake, making connection at the one side with the railway survey of the Keepawa branch up the head of Gordon Creek (Norcliffe) and with the survey of the Ottawa River at the foot of the Long Sault. A large number of smaller lakes were also surveyed in this vicinity and the outcrops of the rock exposed on the shores noted. Proceeding up Lake Temiscaming and *via* the Matabetchouan River to Lake Temagami, a survey was made from Muddy Water Bay, southwards through Wasasinsagamo (Driftwood Lake), Jumping Caribou, Hanging Stone and Red Cedar lakes to the outlet of Temagami River. Returning to Temagami Lake a geological examination was made of the route *via* Gull Lake to Sturgeon River. A micrometer survey was made of Kookaganing and Ashgaming lakes from the outlet of the former into Maskinongéwagaming, connecting with the recent township survey. During the latter part of September and the beginning of October, Mr. Johnston

was engaged on a survey of the roads in the vicinity of Sturgeon Falls and North Bay, and he carefully noted the occurrence of any outcrops of rocks as the survey progressed.

"The greater portion of the sheet 131 is occupied by the granitoid gneisses of the Laurentian. The line of junction between these and the Huronian belt to the north crosses the Sturgeon River near the Elbow, about three miles south of the Maskinongé River. Thence it runs in a north-easterly direction cutting Cross, Hanging Stone and Jumping Caribou lakes, and continues on to Lake Temiscaming.

"The Huronian rocks therefore cover a comparatively small area in the north-western part of the sheet. They consist of what has been called slate conglomerate, with which large masses of dark greenish gray diabase are associated. The strikes of the Laurentian gneiss show that it generally occurs in extensive circular or irregularly oval-shaped concentric areas which anastomose with one another. The occurrence of crystalline limestone on Iron Island, Lake Nipissing, as well as at the Talon Chute on the Mattawa River, are interesting features in regard to the Laurentian of this district, but the presence of these was noted by the Survey many years ago. On the Manitou Islands in Lake Nipissing a fossiliferous limestone was seen resting unconformably on the gneiss and dipping south-west at a low angle. A collection of fossils was made from this locality by Dr. Selwyn in 1884 and afterwards determined by Dr. Ami, from which he refers the strata to the Black River formation. On Iron Island there is also a coarse, friable sandstone or grit resting unconformably on the gneiss, which might be either Chazy, Calceiferous or Potsdam.

"The measurements made were, by micrometer and compass 375 miles, pacing and compass 120 miles, patent log and compass forty-five miles. Total, 570 miles.

"In the micrometer and log surveys the lines of traverse were used as bases for triangulation and thus do not represent the actual work accomplished."

Mr. Barlow finished the season's work and returned to Ottawa on the 8th of October.

The cost of the season's exploration was \$1,273.59.

Dr. Ells was requested to continue the working out of the geological structure in the counties of Ottawa and Argenteuil, more particularly along the rivers Gatineau, Du Lièvre, North Nation and Rouge, with their tributaries; extending north from the Ottawa for nearly 100 miles. On this work Dr. Ells reports as follows:—

"A great part of the exploration was carried on by means of canoes, and was greatly facilitated by using the surveys of the principal chains of lakes on the Nation and Rouge rivers, made prior to 1870 by Mr. James Low, and those made later by Mr. L. R. Orde of the large lakes in connection with the Gatineau. These surveys were made with the micrometer, and, as a rule, were found to be very satisfactory. During September and October the phosphate deposits of the Buckingham district were examined in order to obtain, if possible, further evidence regarding the mode of occurrence of the apatite in this district. In this work the topographical map made by Messrs. Ingall and White was used, and the different bands of limestone, in the area examined, were laid down on it. Mr. H. N. Topley, photographer to the department, made a series of photographs showing the contact of the apatite-bearing rocks with the gneiss, and the manner in which the apatite is distributed. The photographs have been coloured to show these contacts, and the different rock bands more distinctly.

"The boundaries of the Potsdam and Calciferous were traced from the mouth of the Gatineau to St. Jérôme as accurately as the thick covering of drift would permit. The clay deposits, which are very extensive in the Ottawa River valley, for the most part conceal the contacts, so that the lines, to some extent, must be conjectural. The edge of the Laurentian rocks, however, is generally recognized by the prominent escarpment of their southern outcrops, especially well seen for some miles on either side of Calumet station on the Canadian Pacific Railway between Montreal and Ottawa. The clay deposits extend for many miles up the Gatineau, and other tributary streams, and fine sections are furnished by excavations on the new line of the Gatineau Valley Railway, not only in the clays and sands, but also in the Laurentian rocks. The greater part of the clays appear to be of fresh water origin, though beds of marine shells were observed in a cutting about one mile north of Chelsea station.

Collections of the flora of the district, north of the Ottawa, were made by my assistant, Mr. McDougall, and a list of the flowering plants, observed during the summer has been handed to Prof. Macoun.

Though canoe routes occur in many directions, connecting by means of short portages, the headwaters of the Gatineau, Du Lièvre, North Nation, Rouge and other streams, with those of the St. Maurice on the east, and with those of the Upper Ottawa on the west, and though the occurrence of calcareous bands was noted on many of these routes, yet there are many large areas in this district, at present, practically inaccessible for detailed geological examination, being destitute of roads and densely wooded; and even on the canoe routes, many stretches along lakes and streams, show no rock outcrops, owing to

the heavy mantle of drift, and it is possible that limestone bands may occur in these, of which no trace is visible on the surface. It would therefore be exceedingly difficult and costly to trace out, and delineate on the maps these limestone bands, especially in view of the fact, brought out very clearly in the compilation of the Buckingham map, by Mr. White, that many of the old plans of the townships from Crown Land surveys are very inaccurate, and need carefully revising. From the work of the last two seasons, in which, the greater part of the roads between the Gatineau and the North River, in rear of Lachute, as well as the principal canoe routes have been surveyed, it would appear that the views of the structure as published thirty years ago need to be considerably modified. Large portions of the Laurentian are clearly crystalline igneous rocks, as for instance, the anorthosites, the pyroxenites, and great areas of syenite, granite and augen-gneiss. The estimated thickness of the stratiform portion of the Laurentian must also be greatly reduced. In it may be included the grayish quartzose and often rusty gneiss, the red orthoclase and the black hornblende gneiss, certain bands of which are highly garnetiferous, and are associated with regularly stratified areas of whitish gray quartzite, which in places resembles an altered quartzose sandstone. The interstratified character of portions of the crystalline dolomite with the grayish rusty gneiss is also very evident. With these may also be classed some areas of conglomerates where well-rounded pebbles of quartzite and gneiss are clearly scattered through beds of banded limestone.

"The structure of the Laurentian in the area under consideration seems to place the Calcareous divisions at the top of the entire series. The red and gray orthoclase gneiss passes upwards by intercalations of thin bands of limestone, into massive beds of limestone, in places several hundred feet thick.

"The limestone and the underlying gneiss occur in a series of folds in which the synclinals are occupied by the limestone. This structure is many times repeated from the Gatineau to the eastern portion of the area examined. Frequent abrupt changes of dip occur, many of which are due to faults, or to intrusions of dioritic or felspathic rocks. The general strike of the anticlinals is N. 29° E. magnetic, the variation in this district being from 11° to 12° west. In the district between the Gatineau and the North Nation rivers, the occurrence of pyroxenic and felspathic rocks is frequent, the former is generally of some shade of green, the latter generally weathers a grayish white, and from an admixture of quartz and mica assumes sometimes the aspect and composition of granite. The pyroxenic rocks are especially important, as they are intimately associated with the occurrence of apatite, they

often run along the lines of stratification, and have generally been regarded as integral parts of the gneiss. In many places they break directly across the course of the gneiss like dykes, veins or intrusive masses. The apatite deposits are generally associated with these pyroxenic rocks, near the contact with the gneiss, but in so far as observed, in the Buckingham district, the apatite occurs in the gneiss itself only as scattered crystals, with mica, pyroxene, calcite, etc., in the bands of limestone. The horizon of the apatite-bearing pyroxenites is the upper part of the grayish gneiss series, or that part of the Laurentian directly below the limestone formation. The apatite deposits while occurring in the pyroxene near the contact with the gneiss, do not present the character of true veins. The deposits are irregular, sometimes comprising hundreds of tons, and these have frequently been completely worked out, showing them to be entirely disconnected from other deposits; sometimes strings or small leaders from a large pocket connect with another, and sometimes this succession of pocket deposits can be traced for several hundred yards. From the association of the apatite with igneous rocks, no limit can be placed upon its occurrence in depth. In the North Star mine the deposit at 600 ft. deep gave no more signs of disappearing, than do many of those near the surface. At the High Rock mine, the most productive part of the deposit was near the base of the high hill in which the mine is worked. In every observed case of the occurrence of mica and graphite in paying quantities the presence of dyke-like masses of pyroxene or quartz felspar is noted. It is probable also that the same principle applies to the deposits of asbestus, in which, however, the dyke masses are not so clearly defined, but the asbestus occurs encircling lenticular or irregularly oval masses, in veins from one-eighth to half an inch in thickness, several of which occasionally coalesce and produce a vein of fine quality, which extends sometimes for several feet, when it again splits up into the usual small strings. The asbestus from the Laurentian is generally of purer quality than that from the Eastern Townships, being free from admixture of iron grains or earthy impurities, but its shortness of fibre makes it unfit for spinning, and also for many of the purposes for which the long fibre of Thetford mines is specially adapted. The only asbestus mine being worked during the past season, was that of the Templeton Asbestus Co., on the east half of lot 11, range VIII., Templeton. Asbestus similar in quality, however, occurs on lot 16, range V., Portland East, where it was mined to a limited extent several years ago. Near the Gatineau River, a few miles north of Farrelton, deposits of similar character are found similarly situated in the serpentinous portion of the limestone, but they have not yet been worked.

"The most easterly point where it has been seen is in Wentworth, lot 20, range IX., where, however, the veins are too small to mine profitably. In fact small veins of the mineral can be found wherever the limestone becomes serpentinous.

"New deposits of mica are frequently being found, and have been opened at several points, more especially in the areas adjacent to the Lièvre and Gatineau rivers. In the former district a new mine has been opened at the Little Rapids by Mr. W. A. Allan of Ottawa, on lot 6, range I., Portland East, and at the north-east end of Kendall's Lake on lot 26, range XI., Buckingham, by Mr. W. C. Kendall, of Bassin du Lièvre. An opening was also made by Mr. Wm. MacIntosh on the west side of the Lièvre, about one mile below the High Falls. Work has been carried on by Mr. F. O. Lewis, of Montreal, in range III., lot 13, Portland West, where a number of openings have been made, and a considerable quantity of very good mica extracted. This mine is on the west side of Lake Terror, and the mica occurs partly in the gneiss and partly in the limestone.

"A number of new openings for mica have been made in the Gatineau district during the past season, some of which promise well, but these were not examined. The attempts to mine mica on the Rouge River have for the present been abandoned.

"The phosphate mines of the district are for the most part closed, owing to the present depressed condition of the market. Work was carried on during the season at the High Rock, Etna and Ross Mountain mines, and further west at the Blackburn mine in Templeton, but the output in all cases is small.

"In plumbago, the mine owned by Mr. Weart, on the north side of Donaldson's Lake, on lot 26, range VI., Buckingham, has been fitted with new machinery for cleaning the ore, and is now extracting graphite in large quantities. At the Walker Mine on lot 19, range VIII., Buckingham, a large mill for separating and purifying the graphite has been erected, but the mine is at present idle. A new opening for plumbago has been made on lot 13, range X., Buckingham, by Mr. Claxton, of Inverary, Ont., and a trial shipment of 200 tons has been sent to England to ascertain its value. The quantity of graphite here is quite extensive. It is thickly disseminated through a gray rusty gneiss, on the summit of a hill about half a mile east of the Lièvre River.

"A deposit of plumbago is being opened on the south-east end of this lake by Mr. Lewis. It occurs in veins up to two inches thick, in a hard felspathic rock. A new vein has also been opened by Captain Bowie, of Ottawa, at the south end of Big Whitefish Lake, in range XIV., lot 47, Hincks.

"I was assisted during the season by Mr. R. MacDougall, B.A., a graduate of McGill College.

"The field work commenced on the 16th of May and continued to the 26th of October.

"Amount expended, \$1,375.00."

Mr. Giroux left Ottawa on the 4th of June, to continue the examination and revision of the geological structure in the counties of Berthier, Maskinongé and St. Maurice, in the province of Quebec. Mr. Giroux reports as follows on the result of his investigation :—

"Magnetic iron ore was found on lot 363, R. 11, St. Gabriel de Brandon, Berthier county, on the slope of a little hill, about eight arpents to the west of the road from St. Gabriel de Brandon to St. Norbert, where the rocks consist of gneiss varying very much in composition, being in places highly quartzose, and in others highly hornblendic. It dips N. 62° E. at an angle of 70°, and is cut by small irregular veins of white quartz and coarsely crystalline felspar. It is in some of these small veins that magnetite is present in very small bunches, measuring one-eighth of an inch to two or two and a half inches. These small veins contain also brownish mica, in crystals measuring from a quarter of an inch to four inches. The iron ore appears to be of good quality, it occurs however, in such small quantity that it is of no economic importance."

Mr. Giroux then proceeded to St. Michel des Saints in the county of Berthier and left there on the 25th of June, with four men and two canoes to descend the Mattawin River as far as the outlet of "Lac Barré," where a micrometer survey of this lake and its outlet was commenced. Lac Ignace and the chain of lakes and portages leading to Lac à Jean, at the head of Rivière à Jean, which empties into Lac sans Bout were surveyed. The country being heavily drift-covered no rock exposures were found for a distance of six or seven miles to the south-east of Mattawin River. There the gray gneiss crops out, and light brownish, coarsely crystalline syenite is met with as well as quartzose granitic rock containing inclusions of pinkish felspar. On Bottle River Lake, as almost everywhere in this section of the country, the gneiss is in places highly quartzose and in others highly hornblendic, the hornblende being almost pure in small layers or bands. When the gneiss is highly quartzose it is garnetiferous and holds small patches of pinkish calcite with hornblende in small crystals. Where the dip could be observed in this section it varied from S. 18° to 25° E. < 10° to 22°. The boulders along the shores of some of the small lakes are vermilion red and look as if they were blood-stained. These stains can be easily scratched: but as I could

not wash them off, I think they are not of organic origin but composed of sesquioxide of iron. On a small lake at the head of Rivière à Jean, there are ledges of gray, highly quartzose garnetiferous gneiss dipping N. 70° W. $< 22^{\circ}$, but this must be merely a local change in the trend, as a short distance further south-east the rocks dip S. 42° W. $< 10^{\circ}$. On a little lake to the north, and not far from Lac à Jean, there is an exposure about four chains wide of calcareous rock, dark gray-weathering and conglomeratic in appearance, containing angular pieces of quartz and hornblende, crystals of pinkish felspar, garnet, and a black mineral, probably tourmaline. Quartz is also present in small grains, the size of a pea. On Lac à Jean most of the gneiss is reddish brown, and an area of syenitic rock about 500 yards occurs there. From Lac à Jean to Lac sans Bout the brownish gray and dark gray hornblendic gneisses only are seen.

From the confluence or the outlet of Lac Barré into the Mattawin River to Lac sans Bout, a distance of about twenty-five miles in a straight south-easterly direction, eighteen lakes and seventeen portages were surveyed. The party then proceeded to Lac Saccacomie by Rivière à l'Araignée, Lac Violon, Lac Bleu and other small lakes. The same gneisses are very well exhibited all along, and on a little lake near Lac de la Culbute, is an anticlinal in reddish-brown micaceous and feldspathic gneiss which contains pinkish felspar in very large crystals and irregular patches, as well as white quartz in small irregular veins and patches. This anticlinal is plainly seen near the end of the portage road to Lac Carufel, where the gneiss dips N. 25° E. < 10 , and S. 25° W. $< 17^{\circ}$. On a little island in this lake, and associated with the coarsely crystalline pinkish felspar and white quartz are crystals of mica, some measuring about three inches. Coarse syenite, reddish in colour, occurs on the southern shore of Lake Willy, all along the portage from this lake to Lac Saccacomie, and for about three-quarters of a mile along the northern shore of this last lake. Most of the gneiss around this lake is reddish-brown, but on the south-eastern shore a band of about a quarter of a mile wide of gray gneiss dipping S. 3° to 12° E. $< 17^{\circ}$ comes in. Some of the gneiss around this lake weathers reddish and has a mottled appearance due to the weathering out of the quartzose parts. These quartzose patches are bluish-white and appear like fish scales on the weathered surface.

The distance, in a straight course from the south-eastern end of Lac sans Bout to the south-eastern end of Lac Saccacomie, is about eleven miles, and in that distance ten lakes and eight portages were surveyed,

Being almost out of provisions, a fresh supply had to be obtained from St. Alexis, before going across to Rivière du Loup by way of Lac

Carufel. The portage from Lac Saccacomie to Lac Carufel is about two miles long and passes over a mountain, 370 feet higher than Lac Saccacomie, composed of brownish gneiss which is also well exhibited all around Lac Carufel, and in one place it contains small scales of plumbago associated with crystals of garnet and white quartz. Similar gneiss extends north-westward to Rivière du Loup and dips S. 22° to 33° E $< 25^{\circ}$ to 30° .

Rivière du Loup was then ascended as far up as Pembina River, which was surveyed to Lac Pembina, passing over similar gneiss all the way. Near Lac Pembina, a vein of quartz and felspar, eighteen inches wide, cuts across the gneiss and contains large crystals of mica. A few miles north of this lake, mica in large crystals weathers greenish and has a greenish lustre in fresh fractures, and in a little lake, further up is a vein of quartz about twenty inches wide, running S. 33° E. and N. 33° W., for a distance of about five chains. On each side of this vein is a band of pinkish felspar very coarsely crystalline; at the contact of these two minerals are small bunches of magnetic iron ore and crystals of mica about one inch and a half in size. When this vein disappears it consists entirely of felspar, and then the magnetite is more plentiful in it. The quartz which appears in these felspar veins and patches varies in colour from white to bluish white, and when of the last colour it almost always contains mica in quite large crystals. On the 17th of August the main east branch of Rivière du Loup, was reached and as provisions were nearly exhausted two men were sent to St. Michel des Saints for a fresh supply, and a raft was made with which to continue the survey of this river, to its forks with Lac Sorcier branch surveyed last summer. It is on this branch of Rivière du Loup, and about three miles from the forks, that an excavation was made a few years ago in search of mica which occurred in small crystals and in very limited quantity in a dyke of very coarsely crystalline felspar and quartz on the west side of the river and in almost pure quartz on the east side. To the south of this dyke there is a bed of almost pure quartz about sixty-five feet wide which is flanked by a band of garnetiferous gneiss eighteen inches wide. Small crystals of apatite were found in this dyke, near its contact with the gneiss. The east branch of Rivière du Loup; was surveyed to its head, then the Mattawin River was ascended by a chain of lakes. On Lac des Sables, where the men sent for provisions rejoined the party on their return from St. Michel des Saints, there is a small boss of heavy black hornblende ferruginous rock, very rough weathering and coarsely crystalline. A similar rock was also seen in two or three other places. Mica in crystals, two to two and a half inches in size, and traces of iron

ore were observed in numerous places. At Lac des Isles, there is an anticlinal, and north of this lake, as far as Mattawin River, the gneisses dip N. 10° to 37° E. $< 8^{\circ}$ to 27° . About one mile and a half south of Mattawin River, and not far from the supposed line of division between St. Maurice and Maskinongé counties, there is a small band, about nine inches thick, of pink calcite containing a dark-green mineral, probably pyroxene.

In the section from Lac Michelin along Michelin Brook, which empties into Mattawin River not far from Rivière à la Chienne, the gneiss is generally quartzose.

The Mattawin River was then descended as far as Yinkamak Brook, a distance of about thirty-five miles. This river is very rough, there being fifteen rapids between the two points named. The rocks along this portion of the river consist mostly of gray and brownish gray gneiss, which dips S. 35° E. $< 20^{\circ}$ near Rivière à la Chienne. On the portage of Rapide de l'Arachi there is a mass of reddish syenite eighty paces wide. From the head of Le Rapide de l'Aigle No. 3 down to Yinkamak Brook the gneiss dips N. 27° to 73° E. $< 10^{\circ}$ to 40° , and white crystalline micaceous limestone can be seen in highly quartzose gneiss at a short distance from the foot of Le Rapide Pins Rouges. Magnetic iron ore occurs in small quantity at the foot of Le Rapide de l'Ours. From the mouth of Yinkamak Brook to near the foot of Lac Piza Gonge or Mistagance, the same greyish and brownish gneisses are met with. From Lac Piza Gonge Mr. Giroux returned to St. Michel des Saints, where he arrived on the 24th of September. From that date to the 5th of October, was occupied in visiting several localities to the north of Mattawin River and on Rivière du Milieu. Near Lake Cutaway, situated in the township of De Maisonneuve, the gneiss is cut by a vein of whitish felspar and white quartz containing crystals of garnet and scales of plumbago which can also be found in an outcrop of decomposed limestone situated on the outlet of Lake Cutaway, about six arpents from its head. About three-quarters of a mile from this last lake and near a little brook which empties into its outlet, some excavations were made, a few years ago, in search of mica which can be seen in large crystals on the dump alongside the pit. Pieces of apatite were also found in the dump, but none of it could be seen *in situ*. The rock there consists of a much broken quartzose, rusty gneiss containing but little mica and holding iron pyrites in small bunches and cubes.

Serpentine limestone occurs on the side of a high hill in the township of De Maisonneuve near the supposed line of division between Berthier and Maskinongé counties, and about five miles south-east of the northern boundary line of the township of De Maisonneuve. This

limestone is highly micaceous in places, mottled yellowish, friable when not serpentinous and contains scales of plumbago. The whole hill is covered with drift and therefore it could not be determined how far this limestone extended, but it can be traced for about ten chains. An excavation has been made there in search of asbestos, but none could be seen.

The mica of the De Maisonneuve mica mine occurs in a dyke of coarsely crystalline felspar and quartz; it is of a very good colour, but unfortunately the crystals are so much intermixed and twisted that it is of little value. On the east shore of Rivière du Milieu and about three miles and a half north-west of Lac des Pins, there is a deposit of iron ochre of indian red and vandyke brown colours which has been worked by Mr. Gaucher, of Montreal, who had a few tons of it dried and sent to him to test, but no work has been done lately. Limestone is burnt for lime in two places in the township of Brassard, and in one of these quarries on lot 20, range C, this rock is micaceous and serpentinous in places, and very small thread-like veins of asbestos were noticed in it. On lot 44, range B, Brassard township, the micaceous and hornblendic gneiss dips S. 75° W. < 85° and is cut by a small irregular honeycombed quartz vein, which has been opened by a settler; it contains a little iron pyrite and plumbago.

From the 10th to the 17th of October, fifty-nine miles of roads were surveyed in the neighbourhood of Ste. Emilie, St. Côme, St. Jean de Matha, St. Damien and St. Gabriel de Brandon. From the 18th to the 30th of the same month was occupied in the vicinity of St. Didace, St. Alexis, Ste. Ursule, St. Paulin and St. Norbert in tracing the limit of the syenite area of that district.

The old mines and other points of interest about Joliette, Radstock, St. Alphonse and Chertsey were then examined; the Canada Iron Furnace Co. of Radnor has been working actively since the middle of September in ranges III. and IV. of the township of Joliette, St. Ambroise parish, Joliette county. It was learned from the company's foreman that the deposit of bog iron ore on range III., township of Joliette, was one of the best yet worked by the company. It varies from twelve to eighteen inches in thickness and is about three chains wide by five chains long. This company has worked at a small deposit of magnetic iron ore in concession St. Charles, Rang Double, of the parish of Ste. Ursule, and expects to ship about 100 carloads of ore from St. Ambroise parish, and about forty carloads from the parish of Ste. Elizabeth.

A small deposit of infusorial earth has been discovered near a small lake, a few miles north of Chertsey, and the inhabitants use this material for whitewashing their buildings.

Mr. Giroux went to Quebec to get copies of certain plans of surveys made lately in the northern part of Berthier county, relating to Ottawa, and before coming back went to Vaudreuil and Rigaud to get copies of plans needed by Dr. Ellis.

The surveys during the season included 235 miles of rivers, lakes and portage roads by micrometer and prismatic compass, and 163 miles of roads with the wheel.

Mr. Giroux returned to Ottawa on the 22nd of November.

The cost of the season's explorations was \$1,053.09.

Professor Laflamme furnishes the following statement of the observations he was requested to make in the counties of Charlevoix and Montmorency during the vacation of 1892.

"The whole time was devoted to identifying and locating the supposed Cambro-Silurian deposits said to exist in the mountains of the counties of Charlevoix and Montmorency, as well as in the neighbourhood of Lake St. John.

"The supposed outcrops of limestone, the examination of which has been loudly called for, were only dark 'slightly calcareous sandstones. Moreover in my long researches in these different localities I have never found these sandstones in place. I have always met with them as detached blocks, sometimes of great size, but as they are always mixed with morainic debris of all kinds, the determination of their origin is absolutely impossible.

It may meanwhile be noted, that in pursuing my work to the south of Lake St. John, I have found a series of well marked terraces at 600 to 700 feet above the actual level of the lake. I do not suppose that these indicate the ancient shore of Lake St. John; they rather owe their origin to a series of small lakes lying to the south of the great lake; the waters of which have drained themselves towards Lake St. John. It is not uncommon to find at the centre of these stages of terraces, a pond more or less large, which constitutes all that remains of the ancient lake.

"After the series of explorations that I have made extending over several years, in the search for Cambro-Silurian in the Laurentian area; I think I may say that there is no reason to believe in the existence of such deposits outside the large hydrographic depressions the centres of which are occupied by Lake Mistassini and Lake St. John. If such deposits existed elsewhere they have been removed by atmospheric and glacial erosion.

"I regret that I have to offer you such meagre results, but I have thought best to confine myself above all to the examinations of all pos-

sible layers of Cambro-Silurian in the territory assigned to me, to the exclusion of everything else."

Mr. Low, accompanied by Mr. A. H. D. Ross, B.A., as assistant, left Ottawa, on the 26th of May and arrived at Lake St. John on the 30th of May.

Here canoemen were engaged and arrangements for the transport of provisions to Lake Mistassini were made. Owing to the late spring freshets in the rivers the party were unable to start until the 13th of June.

The Achouapmouchouan River was ascended from Lake St. John fifty-eight miles to the Shegobiche branch. This stream was followed to Shegobiche Lake, and from there a portage was made to a small stream falling into the south end of Lake Ashouapmouchouan. A track survey was made of this part of the route and connected at both ends with Mr. Richardson's survey* of the main river. The Shegobiche River is a small stream much obstructed by rapids and falls and only navigable with loaded canoes during high water.

From Lake Ashouapmouchouan the Nikaubau River was followed to the height of land, and from there Obatagoman, Chibougamoo and Wakiniche Lakes were passed through to Lake Mistassini, where the Hudson Bay Post was reached on the 29th of June. On the way from the height of land to Mistassini, the rock exposures along the route were examined and a collection of specimens made from the Huronian rocks of that region, including the deposits of pyrites which occur in abundance in the green slates and diorites of Lake Chibougamoo. At Lake Mistassini the four men engaged bringing in provisions were discharged and returned to Lake St. John.

Leaving the post on the 1st of July a trip was made to the outlet of Lake Mistassini, and a survey line carried from there to the mouth of the Temiscamie River in order to connect the survey of Mr. J. Bignell from Bersimis with those of Messrs. Richardson and McOuat from Lake St. John.

Returning to the post on the 6th of July the party left again next day accompanied by an Indian guide, who knew a route to Lake Kawashagami on a tributary of the East Main River. While on Lake Mistassini a complete set of specimens was obtained from the different beds of limestone there.

At the short portage that passes between the lake and the Rupert River a micrometer and compass survey was commenced and carried from there to the mouth of the East Main River, thus

connecting Mistassini with the point established by Mr. Ogilvy at East Main in 1890.

A few miles below where the Rupert River was reached it is divided by a large island, and these two streams do not again unite for nearly 100 miles.

The eastern channel was descended in a northern direction for about fifty miles, where it turns west to join the other channel. The river runs with a swift current between low rocky banks, and is greatly obstructed by small rocky islands.

Leaving the Rupert River the route passes over the watershed to Lake Kawashagami, through a number of small lakes connected by portages. The discharge of Kawashagami was then followed and the East Main River reached on the 17th of July. The distance between the Rupert and East Main rivers by this route is fifty-eight miles. The surrounding country is rough and barren, and covered with innumerable boulders. The trees are small and consist of black spruce, tamarack and banksian pine, with a few white birch and aspen poplar. Small lakes in this region fill the valleys between the low-rounded ridges of hills, and cover fully one-quarter of the surface.

The East Main River was ascended about forty miles to the first rapid above the Tshegami branch, and from there the survey was carried 308 miles to its mouth, arriving there on the 13th of August.

The East Main River, in its upper part, flows almost level with the surface of the country, and lake-like expansions with deep bays covered with islands are frequent. Many of the islands are large, and one is over twenty miles long. The portage route from the Rupert River strikes the East Main River near the foot of this island.

For over 100 miles from its mouth the river runs in a shallow valley cut into stratified sands and clays. It is fully as large as the Ottawa, at Ottawa city, with an average breadth of a third of a mile. At several places along its course the river contracts and plunges through gorges in heavy rapids and falls; smaller rapids are numerous, and altogether it is probably the most difficult to navigate of all the rivers flowing into Hudson's Bay.

The rocks along the route between Lake Mistassini and the East Main River are all of Laurentian age, being made up of red syenitic gneiss, with pink and gray, mica and mica-hornblende gneisses. Along the Upper East Main River a coarse light-gray pegmatite and black mica-schist predominate, and are associated with pink mica-hornblende gneiss. Lower down stream these give place to an area of light gray and light pink syenite; followed by dark green altered hornblende and chlorite schists, with diorite and a dark gray micaceous schist, be-

coming in places a conglomerate from the presence of rounded pebbles of syenite. This series of rocks closely resembles those north of Lake Huron. The green schists at and near their contact with the diorite masses, are highly charged with pyrites; the diorite also holds considerable quantities of that mineral. In several places large masses of almost pure pyrites were found, and specimens of these are now in the hands of Mr. Hoffmann for analysis.

This band, or similar ones cross and recross the river at intervals for nearly two hundred miles, the strike of the rocks being only slightly different from the general curve of the river. Syenite and ordinary Laurentian gneisses occupy the intervals between the bands of Huronian.

Some time was spent along the coast to the north of East Main River in an attempt to make a micrometer survey of the shore, but owing to unfavourable weather and unsuitable boats this had to be abandoned. From East Main the party travelled to Rupert House in a boat the property of the Hudson Bay Company. At Rupert House the boat belonging to the department was found, and in its passage was taken to Moose Factory. From there the Missinaibi River was ascended to the Canadian Pacific Railway, and Ottawa was reached on the 21st of September. During the summer Mr. Ross made an extensive collection of the plants of the country traversed. These have been examined by Professor Macoun, and while not new, add considerably to the knowledge of the distribution of several species.

The equipment belonging to the department and used on this exploration is stored in Ottawa, with the exception of the large boat which is stored at Moose, along with its necessary equipments.

Cost of exploration, \$2,030.12.

Mr. Chalmers left Ottawa on the 17th of May accompanied by Mr. W. J. Wilson as assistant, with instructions to continue investigations in the superficial geology of New Brunswick. Kenneth C. Cochrane, of Brockville, Ont., a student of McGill University, joined Mr. Chalmers at Moncton, N.B., on the 26th of May, also as assistant.

The explorations of the season were carried on in two areas, one in eastern and central New Brunswick between the parallels of 42° and 47° N. latitude, and longitude 65° to 66° W., embracing portions of the counties of Kent and Northumberland and the eastern part of York (sheets Nos. 2 S.E. and 2 S.W. New Brunswick series of maps.) The second area comprised the chief portions of Westmoreland and Albert counties in eastern New Brunswick, and of Cumberland county in Nova Scotia, in latitude 45° 30' to 46° 15' N. and longitude 63° 45' to 64° 45' W. (sheet No. 4, N.W.)

This work was in continuation of that of former years. The party first undertook the examination and study of the surface deposits of the western part of sheet No. 2 S. E. in the valley of the South-west Miramichi River. Messrs. Wilson and Cochrane traversed the roads, while Mr. Chalmers made a canoe trip along the river and its tributaries, the Renous, Dungarvon and Cain's rivers. Work was prosecuted here by Messrs. Wilson and Cochrane till the 14th of June and by Mr. Chalmers for some time later. From here they proceeded to Eastern New Brunswick and Nova Scotia to complete the examination of the area embraced in sheet No. 4 N. W. Owing to the intricate nature of the surface geology of the district included in the eastern part of this sheet, the numerous roads to be traversed, etc., it took until the 15th of September to finish the mapping. Meantime Mr. Cochrane had gone home, having quit field work, on the 10th of September. Subsequently Messrs. Wilson and Chalmers spent some days in levelling the heights of several of the Pleistocene shore lines and marine terraces in New Brunswick and north-western Nova Scotia in order to obtain levels on which to base the barometric work, and to establish more accurately the upper limit of the marine deposits of the post-tertiary age. The party then returned to the upper South-west Miramichi, taking up the work on sheet No. 2 S. W. in the eastern part of York county, N.B. Explorations in this district were extended along the line of the Canada Eastern Railway and Nashwaak River till the 14th of November. Later on some points along the railway lines in north-western Nova Scotia were examined, and further study of gravel ridges and marine terraces made till the close of fieldwork.

On the result of the work Mr. Chalmers reports as follows:—

"The season's investigations are of much interest. In New Brunswick little was added to the store of facts previously known regarding the Pleistocene geology, the observations being in almost every instance confirmatory of conclusions already arrived at. More attention than usual was given to questions relating to the dispersion of boulders, and greater detail in this investigation attempted. The relative distribution of transported boulders in different parts of the Carboniferous area, for example, was ascertained by counting them. All boulders above a minimum size of three inches in diameter on measured areas were thus examined and the different kinds noted. The results were in many cases quite different from what one would arrive at by the usual methods of observation.

"The data respecting glacial striæ and boulder transportation from the higher central parts of New Brunswick when thus examined in detail were all found to be in harmony. Good evidence of the shedding of the Pleistocene ice from the divide between St. John and

the South-west Miramichi waters south-eastward and north-eastward was obtained, and corroborative testimony on this point was adduced from the distribution of the drift.

"In Cumberland county, N.S., the phenomena relating to the surface geology are, as stated, unusually complex. The glaciation appears on the whole, to have been quite local, more so even than in New Brunswick, as might naturally be expected from the insular situation of the province. Numerous different sets of striae occur on the slope between the Cobequid Mountains and the Straits of Northumberland and it is difficult to say in which direction the dominant ice-movement was. The higher grounds of Leicester Road and Springhill seem to have been centres of distribution for land-ice ; but floating ice has undoubtedly played an important part on the lower coastal tracts. Across the Isthmus of Chignecto floating ice seems to have moved in a general south-westward direction from the straits of Northumberland to the Bay of Fundy, but along these Straits east of Baie Verte it flowed in the direction of N. 70° E. to due east. These floating ice-jams produced heavy deposits of boulder-clay in the low-lying districts. Independent of these ice-movements, and probably of a later date, are the evidences of a northward flow of ice from the Cobequid Mountains over the tract intervening between them and the present shore of the Straits of Northumberland. To the west of Springhill and south of Leicester there was an ice-flow southward and westward towards the northern base of the Cobequids and thence deflected outwards towards the Bay of Fundy south-westwardly.

"The Cobequid Mountains themselves exhibit some very puzzling glacial features. The greater part of the northern slope is without any traces of glaciation, either in the form of striae or boulder-clay, the rock surfaces being broken and jagged and covered mainly with their own *débris*. No great glacier from the north or floating ice has impinged against the northern face of these mountains. Wherever any traces of ice action are visible it is evident the movement was northward down the slope. On the summit there were gathering grounds from which ice flowed locally in different directions, mainly, however, southward. The effects of ice action are very unequal ; in some places the striation is very light, in others quite heavy. Great quantities of *débris* from the Cobequid Mountains cumber their slopes, and it is evident they have been the seat of erosion, at intervals, since the Carboniferous period, if not previously.

"One of the problems connected with the surface geology of the Cobequids is the presence of sandstone and conglomerate boulders scattered over their summits apparently derived from the Carboniferous rocks to the north which lie from 200 to 400 feet lower (referred

to in 2nd ed. of *Acadian Geology*). In the absence of any evidence that glaciers or floating ice impinged against the northern slope of these mountains or surmounted their summits, and with the positive proofs of glaciers and floating ice having moved in various directions over the district to the north, it is difficult, indeed impossible, to account for the transportation of boulders, in the direction supposed, on the view that the relative levels of these plains and the hills were the same in the glacial period as at present.

"The theory which has suggested itself to the writer in regard to this matter is that these boulders are remnants of Carboniferous rocks which formerly transgressed upon the crystallines and which have been almost wholly denuded as the mountains sustained a differential uplift relative to the adjacent country in pre-glacial or early glacial times ; but further study of the phenomena is required.

"The more exact levelling of Pleistocene shore lines which has been made during the past summer has brought out some new features respecting the irregularity of the last great upheaval of the land. This upheaval seems to have been somewhat greater in New Brunswick than in Nova Scotia, and locally greater along hill and mountain ranges than in level districts. The Cobequids, for example, appear to have been uplifted more than the Carboniferous tract near the Straits of Northumberland, i. e. according to the levels of post-glacial marine terraces and shore lines ; and similar facts in support of local irregularities in the oscillatory movement were observed in New Brunswick.

"Kames and terraced gravels, sands, etc., are found in many parts of Cumberland county, the most noteworthy of the former being the 'Boar's Back' along River Hebert. The terraces on the east side of the valley in which Halfway Lake lies appear to be marine, and if so River Hebert valley and the Parrsboro' pass in the Cobequids formed a strait during the post-glacial subsidence of the land. The materials of the terraces referred to and of the 'Boar's Back' were thrown down at this stage, and the erosion which took place during the rise of the land which followed shaped the latter. A post-glacial lake existed at Halfway River of which Halfway Lake is a remnant, and the discharge from this was by River Hebert valley. The details here are of great interest, but investigations are not yet complete.

"Observations on the subsidence of the land around the head of the Bay of Fundy in the Recent Period were continued and additional facts obtained. At the public wharf at Edgett's Landing, Albert county, in the mouth of the Petitcodiac River, stumps of trees *in situ* occur thirty-eight feet below the highest neap tides, or nineteen feet below mean tide level. They are firmly rooted in what must have been upland soil. This fact taken in connection with the evidences of recent sub-

sidence at Aulac, Intercolonial Railway, and at Fort Lawrence dock, Chignecto Marine Railway, recorded in former reports, leave no doubt that a sinking of the land has taken place here since the last upheaval in post-glacial times.

"The agricultural character of the district explored in New Brunswick during the season is closely similar to that of the Carboniferous area of the province described in previous reports. Along the South-west Miramichi and its branches, especially the Renous and Dunganarvon, there are some fine intervals. In the wider parts of the main South-west valley as at Indiantown, Blackville, Doaktown and Boies-town, meadow lands of considerable area are under cultivation. The uplands are likewise of good agricultural capabilities, especially near the rivers, and wherever they have sufficient natural drainage to carry off the surplus waters. Upon the belt of country underlaid by the Cambro-Silurian and Lower Carboniferous rocks, which however, is still forest-clad, there are large tracts of excellent land available for settlement as soon as roads are opened up to them.

"The low-lying Upper Carboniferous plains and the salt marshes around the different arms of the Bay of Fundy in Westmoreland county, New Brunswick, and Cumberland county, Nova Scotia, have long been known as the best agricultural districts in the Maritime provinces. Large portions are cleared and tilled. Better systems of cultivation are now introduced, and the effect of the improved methods inculcated by the Experimental Farm at Nappan, Nova Scotia, is becoming apparent in the districts around it.

"The forest growth of the respective districts examined has been mapped with as near an approach to accuracy as the nature of the country and other circumstances would permit. In the tract drained by the South-west Miramichi, especially upon the Carboniferous area, forest fires have destroyed the larger portion of the original growth, at various times within the last three-quarters of a century. On the higher grounds to the north-west, occupied by the pre-Carboniferous rocks, the original forest prevails, often as heavy timber, consisting principally of deciduous trees, the evergreens (spruce, pine, etc.,) having been largely cut away.

"In Cumberland county, N.S., but little of the original growth remains, except on the Cobequids. On these there is a dense forest of hardwood, interspersed with spruce, pine, hemlock, etc. To the north of the Intercolonial Railway between Macan and Salt Springs stations, also in the districts west of Springhill Mines, and between River Herbert and the Bay of Fundy, there are still areas covered by the old forest.

"The materials of economic importance which came under our observation during the past season are as follows :—

"Infusorial earth (tripolite) is found at Folly Lake, Fountain Lake and Sutherland Lake, on the Cobequid Mountains. Considerable quantities of this material occur at the two first-mentioned places, but scarcely anything has yet been done towards utilizing it. These deposits are described by Dr. R. W. Ells in Annual Report, Vol. I., 1885, pp. 70-71 EE.

"The bog-iron deposits (ferric oxide) known as the "paint mine," near Chaplin Island on the North-west Miramichi River, were re-examined, (referred to in Annual Report, Vol. III., 1887-88, p. 3 N.) This ore seems to be in process of formation and is now being deposited on the rock surface along the bank in several places through the agency of springs. Peat bogs and swamps lie behind, the decaying organic matter in these yields acids that are doubtless instrumental in the production of the ore. The "paint" formed from the oxide is reported to be of good quality.

"Bog manganese, in a loose amorphous condition, has been found near Harvey, Albert county, N.B., similar to that occurring at Weldon Creek, referred to in the Summary Report for 1891, p. 34.

"Brick-kilns are in operation near Amherst ; at Oxford ; on Pugwash River about half a mile from Conn's Mills, and at Wallace River near the bridge of the Oxford and Pictou Branch Railway. Brick-clays are abundant in many parts of the district.

"Argentiferous galena, and iron and copper pyrites, reported to contain traces of gold, occur along the North-west Miramichi River, between the mouths of two of its tributaries, the Tomogonops and Little rivers, in Cambro-Silurian slates which are traversed by broken quartz seams. These minerals are found under somewhat similar conditions to the pyritous and galena ores near Bathurst, on the south side of the Baie des Chaleurs, and appear to be of much the same character.

"The discovery and opening up of a coal seam in the eastern part of Gloucester county, N.B., on the south side of the Baie des Chaleurs, having been reported, I visited it late in the season. The coal crops out in the bank of a small brook on a road leading south from Upper Caraquet, and about four miles and a half distant from that place. A trench cut into the bank exposes the coal seam, which is sixteen inches thick, and has another thin seam overlying it, with a parting of fire-clay between them. A short distance farther east a shaft has been sunk, but was partly filled with water on the occasion of my visit, and I did not see the coal seam there. The workmen, however, informed

me that it was somewhat thicker than where I measured it; and in the heap of coal on the bank taken from this opening, the quality seemed better, that is, the coal was harder and came out in larger pieces. The dip of the seam corresponds with that of the sandstone strata, being 5° to 10° eastward, and consequently the thickness of rock overlying it becomes greater in that direction.

"Photographs of a number of exposures of glacial striæ, some of them evidencing the action of floating ice, were taken. We also photographed several Pleistocene shore lines as well as sections in excavations of the superficial deposits, especially that showing the forest bed in the opening for the western dock of the Chignecto Marine Transport Railway.

"Field work closed on the 21st of December, and on the 25th I reached Ottawa, Mr. Wilson remaining to copy barometric readings at the Meteorological stations at Fredericton and Chatham and reaching Ottawa on the 31st of December.

"The cost of the season's explorations including Mr. Cochrane's salary was \$1,407.51."

Mr. Faribault left Ottawa on the 14th June, with instructions to continue the detailed surveys of previous years and make further study of the structure of the gold-bearing rocks of the Atlantic coast of Nova Scotia.

The district surveyed lies westward of that surveyed in 1891 and extends on the north-west side of the Intercolonial railway, from the Nine Mile River to Bedford and as far as the Gore, Central Rawdon, Newport, Mount Uniacke, Lake Pockwock and Hammond's Plains; covering an area of 190 square miles in Hants county, and 160 square miles in Halifax county. Besides this, Mr. Laberge surveyed with the odometer 180 miles of roads in Halifax county and thirty-five miles in Lunenburg county, to be used as tie-lines in next year's contemplated work.

The region examined is occupied entirely by the auriferous Lower Cambrian rocks which are the extension to the south and south-east of the rocks described last year; while on the north they are unconformably overlaid by the Lower Carboniferous studied by Mr. H. Fletcher, and on the west come against the most eastern spur of a great mass of granite and granitoid rock, supposed to extend uninterruptedly to the western part of the province.

The various east and west plications of these rocks, and more especially their anticlinal axes were minutely examined and traced, as in former years, on account of their close relation to the auriferous belts.

Those of Waverley, Oldham and Carroll's Corner, traced last year to the Beaver Bank road, were followed westward. The first crosses the Windsor road half a mile north of its junction with the old Cobequid road, the old Hammond's Plains road at the south end of Sandy Lake, and Karney's road at the head of Karney's Lake, beyond which it strikes the granite mass. Many quartz veins have been prospected to a small extent along this line, particularly in the vicinity of Karney's Lake where veins showing a little gold have been opened.

Some five miles and a half further north is the anticlinal fold of the Oldham gold district which flattens out and disappears three miles east of the mine; while to the westward its axis dips westerly so fast that at the railway bridge on the inlet of Grand Lake, the lower auriferous quartzites are entirely covered by the upper graphitic slates. The latter form here a belt nearly three miles wide, crossing the Windsor road between the Upper Sackville post office and the fork of the roads, one mile south of Middle Sackville post office and striking the granite mass at Hammond's Plains. Good paving slabs and a little roofing slate were quarried in this belt at Beaver Bank station, where the stratification is horizontal and the cleavage perpendicular to it, making the splitting very easy. Outside the district of Oldham this anticlinal is apparently of no economic importance.

Two miles north of it is Carroll's Corner anticlinal. It crosses Key's Brook half a mile above the road, where some exploratory work on two or three auriferous leads was done a few years ago, and running westward crosses the Shubenacadie River, along which it is concealed by a narrow basin of Lower Carboniferous rocks, passes about Enfield station, strikes the outlet of Grand Lake and its north-western shore at the mouth of Rocky Brook, crosses Sandy Lake, the north end of Square Lake and the Windsor road at Lewis Lake and ends at the mass of granite on Pockwock Lake. That no prospecting has been done along this anticlinal west of Key's Brook is probably due to its being in great part covered by forest and thick soil, but no doubt systematic exploratory work would reveal auriferous veins, especially between Grand Lake and Lewis Lake.

The next folds further north are covered over at their eastern extremities by the Lower Carboniferous basin of the Shubenacadie River and have not been met with to the eastward. It is very probable, however, that the first anticlinal passing through South Uniacke gold district and the black slate belt north of it are the prolongation of the folds already traced immediately south of the Lower Carboniferous basin of the upper Stewiacke River. The South Uniacke anticlinal, unlike any other fold, has flat dips on its south side for a distance of over a quarter of a mile, while its north side is perpen-

dicular. The rich "Hard lead," worked by Mr. Thompson in this district, lies as much as 900 feet north from the apex of the fold. But it is important to notice here that this lead, like most of the richest leads worked in the province, is situated at the limit of the curvature of the denuded fold, or in other words where the dip of the fold, after having gradually increased from 0° at the apex to an angle varying from 45° to 90° , becomes uniform, and does not change for a certain distance. It is, to a certain degree, for the same reason that in sharp anticlinal folds the richest leads are situated near the apex, as at the districts of Salmon River, Fifteen Mile Stream, Killag, Carribou, Mooseland and the west end of Oldham; while in broad anticlinal folds, like those of Renfrew and the east end of Oldham, the richest leads are generally at a considerable distance from the apex. The anticlinal appears to extend only a short distance east of the gold district of South Uniacke, but to the westward a great many quartz leads might be prospected with advantage as far as the Windsor road which it crosses a quarter of a mile north of the county line to come against the granite west of Lacy Mill Lake.

The black slate belt, in the synclinal trough between this anticlinal and the next, is one mile and three-quarters wide where it crosses the Renfrew road about the north end of Grand Lake, but further west, at the Eller Settlement on the Windsor road, a small anticlinal fold brings up a band of lower "whin" rocks one mile wide, thus dividing the slate belt into two bands, the south one three-quarters of a mile wide extending but a short distance further west to the granite mass on West Lake, while the north band, only a few hundred feet wide, disappears and is replaced by "whin" before reaching the granite mass.

A quarter of a mile above the mouth of the Annand Brook on the north side of Grand Lake, there is a most promising deposit of good red hematite in the conglomerate of the Lower Carboniferous at its contact with the south edge of the last described ferruginous and graphitic slate, to which it owes its origin. The deposit is of the same character as that opened at Newton Mills in Colchester county. Explorations have been made lately; a tunnel, thirty-three feet long, has been driven in the solid slate and small pits have been dug in the conglomerate. It is certainly useless to look for the ore in the solid slate, but prospecting in the conglomerate along the line of contact would no doubt reveal important bodies of ore.

North of the slate belt is the Mount Uniacke anticlinal fold. Its eastern end has the form of a broad elliptical dome, on the south side of which are situated the Renfrew gold mines operated for many years,

but very little worked at present. Running westward, this anticlinal passes south of McGrath Lake, and west of Beaver Bank road it appears to have been disturbed by a fault with a thrust of a mile or so to the south on the west side. Resuming its course westward, it has all the leads of the gold district of Mount Uniacke, once so extensively worked, on its south dips, and crosses the Windsor road at the middle of the large bog, half way between Mount Uniacke station and Lakeland, beyond which it comes in contact with the granite. This anticlinal, the most important in the region surveyed and the fault above mentioned require further examination. Suffice it to say at present that systematic explorations in the last two mentioned gold districts would certainly bring to light a great many new auriferous leads and that many leads worked to small depths and abandoned in the earlier days of the districts could now be worked with profit by the improved and more economical methods of mining of the last few years.

The auriferous quartz veins worked to some extent a few years ago at East Rawdon are apparently on a small local fold of the lower "whin" rocks near the southern edge of the Rawdon slate belt and require further examination.

Some three miles and three-quarters north of the Mount Uniacke anticlinal is the broad and well known slate belt of Rawdon Hills. The eastern point of this belt extends as far as the Bar Settlement, where it is covered by the Lower Carboniferous. At Upper Rawdon it has a width of five miles and a half, on the Beaver Bank road, between George Wallace's and the Gore; at Central Rawdon, of four miles between South Rawdon post office and Woodville; it extends west a short distance beyond Upper Newport and Ardoise Hill, where it is covered by Lower Carboniferous gypsum and limestone. These rocks are lithologically the same as those of the upper graphitic slate group of the Lower Cambrian, like them they rest conformably, along their southern limits, on the lower quartzite rocks and are undoubtedly of the same age. Certain forms from the slate of the Northup mine, Central Rawdon, believed to be of organic origin, have led some to suppose that they were newer; but a large number of specimens collected here by Mr. Fletcher in 1890 and last summer by the writer, have been found on microscopic examination by Mr. T. C. Weston* to be merely dolomitic concretions.

The Rawdon slate belt is plicated in a synclinal and anticlinal fold.

*Summary Report, 1890, page 40; Trans. N.S. Inst. Sc., Ser. 2, Vol. I, page 137.

The latter passes a short distance north of Central Rawdon, and at Upper Newport, brings up along its apex a narrow ridge of the lower quartzite group with numerous quartz veins, some of which (one mile west of Upper Newport post office) were prospected and found to be auriferous. Quartz veins of great width and length, cutting these up-tilted slates at a right angle, are very numerous, and those worked so successfully a few years ago at Central Rawdon and found to contain such rich pockets, belong to the group of true fissure veins. No doubt these veins were formed by segregation out of the adjacent auriferous slates, but it is not probable that gold is as uniformly distributed through the whole thickness of these slates as it is through the "whin" series, and moreover as no structural indication is yet known as a guide to the location of the auriferous cross veins, these slates will never be as tempting a field as the "whin" series, where systematic prospecting along anticlinals directed by experienced mining engineers, well acquainted with the peculiar structure of the Nova Scotia gold districts, is likely to be successful. These Rawdon slates are, on the east, north and west sides unconformably covered by the Lower Carboniferous rocks.

The following table compiled from the annual reports of the Department of Mines of Nova Scotia, gives the yield of gold from each of the five districts examined last season, for the five years ending 31st December, 1891:—

District.	When first worked.	Tons crushed.	Yield of gold per ton.	Total yield of gold.
			Oz.	Oz.
South Uniacke*.....	1889	462	10.48	4,842
Mount Uniacke.....	1866	7,573	0.46	3,503
Renfrew.....	1861	5,960	0.89	5,309
Central and East Rawdon.....	1884	11,389	0.79	9,058
Total.....		25,384	0.90	22,712

*Yield from October, 1889, to November, 1892.

The above averages of yield of gold per ton are certainly very satisfactory when it is remembered that, in most mines properly equipped and economically worked, a yield of 5 to 15 dwt. of gold per ton ought to pay.

The West Gore Antimony mine, operated from 1884 to 1890, was, when visited, filled with water, consequently very little can be said about it. The principal ore is stibnite, sulphuret of antimony or gray antimony, with a little kermesite or red antimony and traces of native antimony. It occurs in a quartz fissure vein cutting the

slates at right angles, in apparently the same manner as the gold-bearing veins of Central Rawdon. Dr. Gilpin in the report of the Department of Mines of Nova Scotia for 1884, makes the following remarks: During the past year a valuable mine of antimony ore has been opened out at Rawdon, Hants county. Two shafts, about 120 feet apart have been sunk about 175 feet, and levels driven, and 600 tons of No. 1 ore raised. The vein which is of gray antimony ore, is from four to eighteen inches in width, cutting talcose slates. There is little impurity present beyond small amounts of quartz and calcspar. An analysis by Mr. M. H. Smith showed the ores to be almost of chemical purity, having little beyond mere traces of foreign material. This discovery has led to prospecting for other deposits of the ore, and it is probable that a large district here will be found to yield it. Similar ore has been reported from Upper Stewiacké, Melrose and Trafalgar." The amount of ore annually exported since the opening of the mine is taken from the reports of the Department of Mines of Nova Scotia as follows:—

Year.	Tons.
1884.....	600
1885.....	758
1886.....	645
1887.....	400
1888.....	308
1889.....	55
1890.....	26

A saline mineral spring was noticed half a mile east of Renfrew, at the contact of the Lower Carboniferous and the Lower Cambrian.

One month was spent during the summer revising the work in some localities in Guysboro' and Halifax counties in order to study a few unsettled points, locate more precisely certain anticlinals and have the maps, which are now being engraved, of that portion of the province which has been under examination for the last ten years, as complete as possible and up to date.

I was ably assisted, as in previous years, by Messrs. Archie Cameron and J. McG. Cruickshank, for five months; and by Mr. F. C. Laberge, C.E., for seven and a half months.

The expenditure on the season's explorations, including the salaries of all assistants, was \$1,550.00.

Mr. Fletcher left for Nova Scotia on the 23rd of June, 1892, to continue the work of previous years in the counties of Cumberland and Hants. He was assisted during six months by Messrs. M. H. McLeod, D. I. V. Eaton and T. S. McLean, and for six weeks by Mr. W. B. Almon.

The district surveyed in Cumberland county lies west of that described in last Summary Report and in the report presented last

spring. It comprises the coast north of Minas Basin from Parrsboro' to Cape Chignecto and east of Cumberland Basin on the outskirts of the Cumberland coal-fields. The inhabitants of the villages on the shore as far as West Advocate are engaged in ship-building and sailing. On Cumberland Basin are the hamlets of Eatonville, Spicer's Cove, Apple River, Sand River, Shulie, Two Rivers, where lumbering is the chief industry, and the interior, with the exception of small settlements, such as Salem, is under forest. The whole coast, the roads and many of the principal streams were surveyed by Mr. Scott Barlow and Mr. Walter McOuat, in connection with the survey of the coal-fields made between 1871 and 1878, as described in the reports for those years, and in Part E, Annual Report, vol. I., 1885.

The geological formations include Triassic, Permian, Carboniferous, Devonian and igneous rocks, similar to those described as occurring along the eastern part of the Cobequid range of hills. The Triassic comprise chiefly masses of basalt and amygdaloid with patches of the characteristic red, soft, crumbly sandstone and conglomerate. On the south side of the hills the Carboniferous rocks appear in greatly tilted masses along the shore, whereas on the north side and along Cumberland Basin, Permian and Carboniferous rocks are found lying generally at a low angle, joining the area covered by those described by Sir William Logan in his celebrated Joggins section.* The limits of these two series do not seem yet to have been clearly defined inland. The Devonian sedimentary rocks resemble those already described in their association with masses of trap, porphyry, diorite, syenite, felsite and quartzfelsite generally massive but sometimes schistose; and their more flinty or porcellanous character near the contact with such masses is as noticeable here as at Portapique and other rivers to the westward. Dark shales and quartzites, very like the iron ore series of Londonderry, containing veins of quartz, blotches of limonite, and associated with light gray, olivaceous, soapy shales, yield at Kirkhill obscure markings of plants. Again, near the shore on Greville River, in the fine outcrops of quartz-veined quartzite and twisted slate, exposed immediately below the first dam, graphitized markings of plants were found, resembling the vegetable debris of Portapique River. These rocks are here unconformably overlaid by a conglomerate of loose texture, composed of pebbles often more than two feet in diameter, of red quartzite and other rocks probably Devonian, interstratified with lenticular patches of crumbly, brecciated red, fine, sandstone, as in other sections on the north side of the hills.

* Report of Progress Geol. Survey of Canada, 1843.

Precisely similar fossil remains were found on the shore at and near McGahey Brook, at West Advocate. Here at the mill-pond, ripple-marked, sandy flags show obscure carbonized markings resembling broken plants. About 165 yards west of the mouth of the brook, obscure traces of rootlets and *Cordaite*s are much more abundant. East of McGahey Brook the shales show many markings like stems of *Psilophyton*, often branching, but only small fragments could be obtained owing to the jointed, cleaved and friable character of the shales. In the associated flinty quartz-veined quartzites much graphitized matter is present in layers which resemble, although greatly altered, the layers of carbonaceous matter so often found among the coarse sandstones of the Carboniferous and consisting chiefly of *Cordaite*s. Further west on the shore these dark shales and flags come against greenish, inassive, epidotic diorite and breccia, succeeded by red and gray syenite and diorite, greatly intermixed, the diorite being first blotched with the syenite, while further west the syenite predominates and is blotched, striped and veined by the diorite, the dykes or veins being sometimes horizontal, sometimes vertical.

Veins of ankerite and veins and spots of specular iron ore occur in McGahey Brook. In one of the branches of the Mahoney Brook where a mass of gray breccia, diorite and syenite is in contact with slates, the latter contain rusty-weathering veins in which calcite, baryte, specular iron ore and pyrite are present. The syenite seems to cut the slates like a dyke, carrying grains of specular iron near the contact, and in one place coarse syenite forms a sheet in the bedding.

On the shore immediately east of Henning Brook, a considerable quantity of iron pyrites is found in crystals and aggregations in a claystone contained in a brecciated quartzite. The ferruginous veins of the black slates of the neighbourhood hold traces of copper pyrites and among the whitish quartzites are spots of specular iron. Several barrels of fine crystalline pyrolusite were obtained last year on the shore at Lower Economy from Devonian rocks similar to those of the manganese mines of Tenycap and East Onslow.

About 125 yards west of the mouth of Barkus Brook and near the contact of the Triassic of West Advocate with the Devonian, fragments of reddish massive gypsum with crystals of anhydrite and white porous gypsum are found in the cliff and are said to be in place on the beach, representing probably another outlying unconformable patch of Lower Carboniferous like those of Clarke Head. The extent of the outcrop on the land can be only a few square feet for Devonian slates are everywhere near in runs and breaks of the bank. The Carboniferous rocks of Spencer's Island consist of red and gray rubbly sandstone grit

and shale, including black calcareo-bituminous shales sometimes coaly; but no coal of importance has been found in any part of this area a large portion of which, however, shows no exposures.

The rocks of the shore of Cumberland Basin between Eatonville and Shulie are interesting as being the extension of those of Sir Wm. Logan's section. Red Devonian slates, and syenite are overlaid near Eatonville by conglomerate upon which, as also near Sand River, ice grooves were found running N. 35° E. At the south side of Spicer's Cove, a red quartzfelsite, containing dykes and blotches of grey and dark diorite and felsite stands against an epidotic breccia and is unconformably overlaid by soft red conglomerate, with fragments of these rocks, which occupies the high cliffs for some distance, then recedes from the coast eastward along what seems to be a large fault on the north side of which are dark and light gray shales and along the line of which the rocks are greatly polished, contain hematite in the joints and a vein of baryte and calcite. The shales are greatly disturbed, are full of carbonized plants and include a two-inch seam of coal, upright trees and underclay. At the mouth of the brook in this cove there are reefs of grey, fine sandstone dipping S. 50° E. at a very low angle, underlaid by reddish or brownish sandstone, in even layers or false bedded, with patches of pebbly grit. North of the brook are outcrops of nut-and-egg conglomerate, among the pebbles of which there are some of gray sandstone containing plants and probably Carboniferous. At a rocky point beyond, brown and reddish grits with interstratified bands, sometimes ten feet thick, of nut-and-egg conglomerate show carbonized markings of plants and extend thence for some distance along the shore which runs about N. 32° E. At Pudsey's Point, a gray sandstone, largely quarried for grindstones, is overlaid by a great thickness of conglomerate to the mouth of Apple River. East of these exposures are others, also of reddish and gray conglomerate, associated with layers of gray pebbly grit, dipping $114^{\circ} < 2^{\circ}$, which is also the inclination on the right bank of the river beyond the sand beach and narrows. Similar rocks are found up both branches of Apple River, some of the pebbles of the conglomerate being of gray micaceous sandstone, of dark gray argillaceous shale and underclay and of fragments of coal. In the East branch above White's saw-mill, there are thick beds of conglomerate, most of the pebbles of which are of hard argillites and quartzites, but others of greenish-gray, soft, flaggy micaceous sandstone like that of the millstone grit or coal measures.

Alternations of brownish sandstones, of red and greenish pea-and-nut conglomerate and of dark gray and red argillaceous shale with layers of gray grindstone occupy the shore from Apple River to Hetty

Point. The red sandstone largely predominates, gray sandstone comes next in abundance, while the shales are scarce, dipping 123° at a very low angle. From Hetty Point to Two Mile Brook the cliffs are scarcely broken and show a large proportion of greenish-gray conglomerate among beds of rusty-brown sandstone, while similar rocks are met on the road to Sand River. Layers of red shale then become more frequent among the pebbly rocks and the dip at one point increases to $160^{\circ} < 50^{\circ}$. Immediately south of Sand River the rocks are also highly tilted but there is no change in their character as far as the point north-east of the river, where greenish and rusty-gray sandstone and conglomerate are overlaid by a considerable thickness of red shale which extends up the river to within 450 yards of the saw-mill. The pebbly sandstones are full of large plants and weather rusty just as in the cliffs to the south-westward. Toward Sand Cove, lower beds are rapidly underlaid by rocks containing much more red shale; but the pebbly layers are still abundant and rusty-brown sandstones largely exposed, sometimes considerably broken but perhaps only by folding of the shales upon the massive grey sandstones, the general dip being low. The gray conglomerate of Fitzgibbon Brook near Shulie, some of the pebbles of which are nine inches in diameter, is precisely like that of Apple River: it is underlaid by red shale and gray fine sandstone and by gray sandstone with pebbly patches, the shore running nearly on the strike. From the bridge on Shulie River to the mouth, the section is slightly ascending, the strata being alternations of red shales with gray and rusty-brown sandstone including several pebbly patches. At the point west of the mouth, rusty-gray and greenish-gray sandstones include three layers of red shale, 18 inches thick, beyond which there is a descent to Fitzgibbon Brook.

On Shulie River below the road from Sand River to Halfway River, gray sandstone, usually flaggy and seldom coarse, with occasional beds of red marl, presents a nearly horizontal southerly dip. Lower down gray flags dip $87^{\circ} < 14^{\circ}$, while nearer the shore, greenish-gray conglomerate is found. On the Half-way River road, mentioned above, east of Jenks Meadow Brook, great blocks of greenish and gray conglomerate are found, succeeded nearer Harrison's by others from the underlying red conglomerate.

A good section of the rocks south of Ragged Reef, is cut by the large stream at Two Rivers. At the road are large outcrops of gray sandstone, some of which is coarse, overlaid by greenish-gray and reddish-grey shale dipping $197^{\circ} < 9^{\circ}$; while upstream similar rocks, largely conglomerates, with fossil trunks of drifted trees, extend two miles up to a driving dam at which rusty-gray sandstone dips $200^{\circ} < 11^{\circ}$. The West Branch of River Hebert and Atkinson Brook also

expose Permian rocks consisting, in the latter, near the river, of gray, rusty, flaggy sandstone with pebbly patches, dipping $170^{\circ} < 8^{\circ}$ and not unlike the rocks of Upper Maccan River. Higher up the dip becomes northerly, the rocks being gray and brownish sandy flags and shales with layers of coarse grit.

Through the kindness of Mr. J. R. Cowans, we obtained plans of the levels, slopes and faults of the working on the three coal seams at present mined at Springhill, to supplement investigations made by Mr. Scott Barlow and Dr. Ells in former years. In this extension, north and south, the workings have not passed beyond the ground proved by Mr. Barlow, but interesting questions have been suggested by the workings to the deep. Records of deep borings in this field, furnished by Mr. R. P. Fraser, Mr. James Baird and Mr. Wm. Hall, will also prove of value in the determination of the structure. In the little brook that flows past the station at Saltsprings and about 1,000 feet from the Intercolonial railway, a small seam of coal has been opened by a shaft or slope more than 150 feet deep, the inclination at the surface being vertical but flattening to 66° and the direction being 305° ; while nearer the railway, the dip varies from 55° to 39° . At a depth of forty-five feet an adit connects the shaft with the brook and lower down a level has been driven north-eastward a considerable distance. The coal is irregular in thickness, being in one place, it is said, seven feet.

The section on the brook is as follows:--

	Ft. In.	
1. Red argillaceous shale with bands of gray sandstone.		
2. Coaly shale with a streak of coal.....	3	0
3. Greenish, crumbly argillaceous shale, of considerable thickness		
4. Soft argillaceous shale with rootlets.....	1	10
5. Coaly shale and clay in thin layers.....	0	6
6. Good coal.....	2	0
7. Clay with rootlets.....	0	7
8. Coal, somewhat impure.....	1	8
9. Soft argillaceous underclay.		

This seam is supposed by some to be the 2 feet 6 in. seam worked at Sand Run mine and on the Springhill and Oxford railway and shown on Mr. Barlow's map. The thickness, however, is greater and the roof is different.

In the small brook about a mile east of the Styles mine and 100 yards west of the Economy road, two seams of coal ten feet apart very irregular in thickness and impure in quality, according to Mr. McCarthy, but containing ten inches of good coal, have been lately opened, at what is called the Stanley mine, in several small shafts, the measures dipping at an angle of 45° .

Mr. Eaton also spent two or three weeks in the Pictou coal-field to add to the topography of the large map of that district. In Hants county he surveyed with odometer 320 miles of roads between Maitland and Windsor, and in the centre of the county; while Ryan Creek and many streams in the neighbourhood of Shubenacadie and Elmsdale were surveyed by Messrs. McLeod and McLean.

The expenditure on the season's explorations, including the salaries of all assistants, was \$1,630.

CHEMISTRY AND MINERALOGY.

On these divisions of the work of the survey Mr. Hoffmann reports as follows:—

The work carried out in the chemical laboratory during the past year has been, as heretofore, almost exclusively confined to the examination and analysis of such minerals, ores, etc., etc., as were regarded as likely to prove of more or less economic value and importance. It embraced:—

1. Analyses of lignites, lignitic coals, coals, and semi-anthracites.
2. Analyses of natural waters—chiefly mineral waters.
3. Analyses of iron ores.
4. Analyses of numerous ores, from the provinces of Nova Scotia, Ontario, and British Columbia, for nickel and cobalt.
5. The assay of a large number of ores from the various provinces, but chiefly from British Columbia, for gold and silver.
6. The examination of a series of clays in respect to their suitability for the manufacture of bricks, pottery ware, and terra-cotta.
7. Miscellaneous examinations, which include the examination or analysis of limestones, carbonaceous and bituminous shales, marls, saline-deposits and other material not coming under the foregoing headings.

The number of mineral specimens received for examination amounted to six hundred and ninety-seven. Of these a large number were brought by visitors who obtained the desired information in regard to them at the time of their visit, or failing this—owing to a more minute examination being called for—it was subsequently conveyed to them by letter. The number of letters personally written amounted to two hundred and seventy-one, of these one hundred and ninety-three were reports embodying the results of the examination, analysis, or assay, as the case might be, of mineral specimens. The number of letters received amounted to one hundred and twenty-seven.

During the period in question a number of minerals—nearly all of more or less economic importance—have for the first time been identi-

fied as occurring in Canada. Amongst these may be mentioned Aikenite, a sulphide of lead, bismuth and copper; Anglesite, sulphate of lead which contains 68.3 per cent of lead; Calamine, hydrated silicate of zinc, a valuable ore, containing 54.2 per cent of zinc; Cerussite (crystallized), white lead ore, carbonate of lead, a rich ore of lead and containing 77.5 per cent of that metal; Euphyllite, Geocronite, a sulph-antimonite of lead; Lepidolite, a silicate of aluminium, potassium and lithium, and Gyrargyrite, ruby-silver, dark red silver ore, a sulph-antimonite of silver; a valuable ore containing 59.8 per cent of silver. The foregoing have in most instances been submitted to analysis, and the results, together with all other information in regard to the minerals, will be given in ensuing reports.

Mr. R. A. A. Johnston has applied himself with great diligence to the work in hand and by the thorough and reliable manner in which he has conducted the same, has rendered excellent service. Apart from a lengthy series of gold and silver assays he has carried out numerous analyses of important minerals, and also conducted a great variety of miscellaneous examinations. Mr. F. G. Wait has been engaged in the analysis of mineral and other saline waters, iron ores, the estimation of nickel in samples of pyrrhotite from various localities and some miscellaneous examinations.

Apart from the writing of the regular annual report "Chemical contributions to the Geology of Canada"—since published, a very full index has been prepared for the catalogue of the Mineralogical Section of the Museum, and in such wise as to show at a glance the localities of occurrence of all the more important economic minerals found in the country.

In the work in connection with the Mineralogical Section of the Museum I have been most ably and diligently assisted by Mr. R. L. Broadbent. He has been occupied in a complete readjustment of the cases containing the systematic collection of minerals in order to allow of the introduction of a number of species and varieties not previously represented; in the transference of the contents of several of the cases, from the one to the other, in the collection of economic minerals, thereby effecting a better general arrangement of the whole; in the labelling and cataloguing of all newly received specimens, and in maintaining the collection generally in an orderly condition.

Owing to the very limited space available for the display of the above mentioned collections, the arrangement of that of the economic minerals in a fairly satisfactory manner, has been beset by many difficulties and if the result attained is not all that could be desired, it is, at least, the best that circumstances would admit of. There is now

no further available space for exhibiting specimens and all new additions have to be placed away in drawers and are consequently not readily accessible to the general public.

The additions to this section of the Museum, chief among which are specimens of rich cinnabar (an important ore of mercury) from Copper Creek, Kamloops Lake, B.C., collected by Mr. E. D. Ingall—amounted to close upon three hundred specimens. Of these, the following were collected by members of the staff:—

1. Bailey, Professor L. W.

- (a.) Ten specimens of stilbite, one of disseminated specular iron, one of martite, two of magnetite partially altered to martite, three of white and amethystine coloured quartz and one of jasper—all from Digby Neck, Digby county, N.S.
- (b.) One specimen of magnetite and four specimens of ilmenite. The former from Nictaux, Annapolis county, the latter from Chegoggin Point, Yarmouth, Nova Scotia.

2. Barlow, A. E.

Some forty specimens of niccolite and gersdorffite from lot 12, range III., of the township of Denison, district of Algoma, Ontario.

3. Brumell, H. P.

- (a) Nickeliferous pyrrhotite from Todd's mine, three miles north of St. Stephen, Charlotte county, New Brunswick.
- (b) Nickeliferous pyrrhotite from Ganong's vein, Milltown, St. Stephen, Charlotte county, New Brunswick.
- (c) Graphite from Thorn Creek, King's county, New Brunswick.
- (d) Graphite from St. John, St. John county, New Brunswick.
- (e) Iron ochre from Champlain island, north-west branch of the Miramichi river, Northumberland county, New Brunswick.
- (f) Howlite from Newport, Hants county, Nova Scotia.
- (g) Calcite, amethystine, from Markhamville, King's county, New Brunswick.
- (h) Manganite, from West Quaco, St. John county, New Brunswick.
- (i) Bog manganese, from Dawson Settlement, Hillsborough, Albert county, New Brunswick.
- (j) Limonite from Lac la Tortue, Champlain county, province of Quebec.
- (k) Auriferous quartz from lot 20, range I, of the township of Belmont, Peterborough county, Ontario.
- (l) Cement stone from the township of Thorold, Welland county, Ontario.

- (m) Cement stone from Limehouse, Halton county, Ontario.
 - (n) Cement stone from Napanee Mills, Addington county, Ontario.
 - (o) Pottery clay from Hamilton, Wentworth county, Ontario.
 - (p) Molybdenite from the township of Hull, Ottawa county, province of Quebec.
4. Ells, Dr. R. W. :—
Chrysotile from lot 11, range VIII., of the township of Templeton, Ottawa county, province of Quebec.
5. Faribault, K. L. :—
Limonite, pseudomorph after pyrite, from gold washing at Little Ditton, Compton county, province of Quebec.
6. Ingall, E. D. :—
(a) Calcite, blue and green, from the High Falls, township of Bowman, Ottawa county, province of Quebec.
(b) Graphite in calcite, from the same locality as the preceding.
(c) Specular iron, from lot 11, range VI., of the township of Portland, Ottawa county, province of Quebec.
(d) Cinnabar, from near mouth of Copper Creek, Kamloops Lake, British Columbia.
(e) Native silver from the "Wellington" claim, vicinity of Bear Lake, West Kootanie district, British Columbia.
(f) Thirty-six samples of ore, representing material from thirty-one claims in the Kaslo-Slocan mines area, West Kootanie district, British Columbia.
(g) Twenty-two samples of ore, representing material from twelve claims in the Illecillewaet mines area, East Kootanie district, British Columbia.
(h) Eight samples of ore, representing material from four claims at the Hot Springs or Ainsworth Camp, West Kootanie district, British Columbia.
7. Low, A. P. :—
Anthraxolite from Lake Mistassini, province of Quebec.
8. McEvoy, J. :—
Sixteen specimens of hyalite from south of Loon Lake, British Columbia.
9. Selwyn, Dr. A., R.C.C. :—
(a.) Samples of coal from Marten Creek, Coal Creek, and Elk River, Crow's Nest Pass, British Columbia.
(b.) Lignite from Estevan, Manitoba.
(c.) Labradorite, from Sheldrake, Gulf of St. Lawrence, province of Quebec.

10. White, J. :—

Raphilite, from the township of Bedford, Frontenac county, Ontario.

And the undermentioned constituted presentations :—

1. Beausoleil, C., M.P. :—

Magnetite, from St. Gabriel de Brandon, Berthier county, province of Quebec.

2. Bennet, L. V., Kamloops, British Columbia, per J. McEvoy (Survey) :—

Five specimens of muscovite from near junction of Canoe and Cold-water Rivers, British Columbia.

3. Brophy, John, Poltimore, P.Q. :—

Phlogopite, from lots 15. and 16, range X, of Portland West, Ottawa county, province of Quebec.

4. DeWolf and Munro, Vancouver, British Columbia :—

Muscovite from near the head waters of Clearwater and North Thompson Rivers, British Columbia.

5. Girdwood, Dr. G. P., Montreal, P.Q. :—

Manganese ore from about two miles and a half east of the head of Loch Lomond, Cape Breton county, Nova Scotia.

6. Haycock, E. B., Ont. :—

Crystal of phlogopite from the Hull mica mine, north half of lot 10, range V. of Hull, Ottawa county, province of Quebec.

7. Huntingdon, J. L. :—

Almandite, from Chegoggin Point, Yarmouth, Nova Scotia.

8. Johnstone, Wm., & Co., Montreal, P.Q. :—

Five specimens of prepared iron-ochres.

9. Jowett, W. A. :—

Jamesonite, from Vermont Creek, Middle Fork of the Spilimichene River, British Columbia.

10. Lampard, R., Montreal, P.Q., per W. F. Ferrier (Survey) :—

Sodalite from Corporation quarry, Outremont, Montreal, province of Quebec.

11. McKay, J. W., Kamloops, British Columbia :—

Cinnabar, from the Rosebush claim, near mouth of Copper Creek, Kamloops Lake, British Columbia.

12. McNeil, The W. H. & Co., Ltd., Anthracite City, N. W. T., per Dr. H. M. Ami (Survey).

Semi-anthracite, from Anthracite City, district of Alberta, N.W.T.

13. McRae, Hector, Ottawa, Ont.

(a.) Native silver from the Wellington claim, Kaslo-Slocan mines, West Kootanie district, British Columbia.

- (b.) Cerussite, from the Wellington claim, same locality as the last mentioned.
14. Moon, A., Madoc, Ont., per W. H. C. Smith (Survey).
Talc, from lots 9 and 10, range V., of the township of Grimsthorpe, Hastings county, Ontario.
15. Nellis, T. F., Ottawa, Ont.
(a.) Phlogopite with inclusions of pyrite—and
(b.) Phlogopite with inclusions of molybdenite; both from lot 19, range XII., of the township of Hull, Ottawa county, province of Quebec.
16. Pite, W., per Dr. G. M. Dawson (Survey).
Concretionary nodule of pyrite from Peace River, N. W. T.
17. Russell, W. W.
Magnetite, from mining location R. 400, Atic-oka River, district of Rainy River, Ontario.
18. Torrance, J. F., Montreal, Que.
Friction bearing made of "fibre-graphite" (wood pulp and graphite).
19. Trowse, A., per C. W. Willimott (Survey).
Section of a crystal of phlogopite with layer of actinolite, from lot 10, range XII., of the township of Hull, Ottawa county, province of Quebec.
20. Willimott, C. E., & Co., Ottawa, Ont.
(a.) Cut and polished specimen of peristerite from Bromley, Renfrew county, Ontario.
(b.) Cut and polished specimen of aventurine felspar from Ross, Renfrew county, Ontario.

Mr. C. W. Willimott has, for the most part, been engaged in making up collections of minerals for various Canadian educational institutions. The following is a list of those who have been supplied with such collections:—

1. High School, Georgetown, O.	consisting of	110	specimens.
2. Collegiate Institute, Morrisburg, O. .	"	110	"
3. School of Practical Science, Toronto, O.	"	110	"
4. Morrin College, Quebec.	"	110	"
5. High School, St. George, N. B.	"	110	"
6. Collegiate Institute, Peterborough, O..	"	110	"
7. Central Schol, Moncton, N. B.	"	110	"
8. Clarenceville Academy, Clarenceville, Q.	"	110	"
9. Queen's County Grammar School, Gagetown, N. B.	"	109	"
10. Public School, Upper Sackville, N. B..	"	109	"
11. High School, Montreal, Q.	"	169	"
12. Public School, Canso, N. S.	"	109	"
13. High School, Deseronto, O.	"	129	"
14. Public School, St. Andrews, N.B.	"	100	"
15. Board of Examiners for D.L.S., Ottawa, O.	"	136	"
16. Grammar School, Berthier, Q.	"	100	"
17. Collegiate Institute, Owen Sound, O.	"	129	"

18. Shelburne county Academy, Shelburne, N.S.	consisting of 100 specimens.
19. Grammar School, Sussex, N.B.	" 100 "
20. Aylmer Academy, Aylmer, O.	" 100 "
21. Collegiate Institute, Lindsay, O.	" 129 "
22. Danville Academy, Danville, Q.	" 100 "
	2498
21. Mr. Chambers, Montreal, Q., in exchange.	" 15 "
Total number of specimens.	2513

In the course of the summer he visited—for the purpose of procuring further material for the making up of collections for educational purposes—the townships of Dalhousie, Bathurst, and Burgess, in Larnark county, and the townships of Bromley and Ross, in Renfrew county, Ontario; Calumet Island and Portage du Fort in Pontiac county; the townships of Hull, Wakefield, Portland, Templeton and Buckingham, in Ottawa county; Montreal, Hochelaga county; the townships of Hatley in Stansted county; Bolton in Brome county; Oxford and Ascot in Sherbrooke county; and Tonquière and Simard, in Chicoutimi county; all in the province of Quebec. Also Minas Basin, between Partridge Island, Cumberland county, and Five Islands in Colchester county, Nova Scotia.

The material collected comprised :—

	Specimens.	Weight.
Agate.	68	
Amazon stone.	48	
Amygdaloid.	36	
Analcite.	56	
Analcite with natrolite.	35	
Apatite.	1	110 pounds.
Barite.	30	60 "
Beryl.	14	
Blende.	24	150 "
Bog-iron ore.	28	
Calcite, crystals.	80	
Chabazite.	120	
Chalcopyrite.	4	312 "
Diabase.	45	
Felspar.	15	
Graphite.	35	
Gypsum.	26	70 "
Hematite.	1	200 "
Heulandite.	50	
Labradorite.	68	
Limestone.	86	
Microcline.	8	
Molybdenite in quartz.	38	
Muscovite.	7	
Natrolite.	10	
Peristerite.	10	
Perthite.	75	
Phlogopite.	32	
Picrolite.	18	25 "
Pyroxene, crystals.	40	
Pyrrhotite.	3	150 "
Quartz.	200	250 "

	Specimens.	Weight.
Raphilite.....	26	80 pounds.
Sandstone.....	25	
Sandstone conglomerate.....	60	
Siderite in schist.....	45	
Steatite, pseudomorphous.....	60	
Stilbite.....	20	
Wilsonite.....	20	

Total specimens collected..... 1,577

Amongst the foregoing were some handsome cabinet specimens, many of which advantageously replaced, as representing the mineral better, those already contained in the Museum.

On the arrangement and classification of the stratigraphical collection of rocks, and other work of the past year, Mr. W. F. Ferrier, lithologist, reports as follows:—

“During the year the work on the stratigraphical collection of rocks has gone steadily forward. In the early part of the year the remaining 141 drawers, containing some 4,000 specimens, were carefully gone over, and a preliminary list of the contents of all the drawers and exhibition cases is now being prepared.

“An arrangement has been made whereby all the drawers under the flat cases are now occupied by the collection of rocks, thus keeping them together, and simplifying the work of cataloguing them. Since the 12th of December, I have been ably assisted by Mr. Percy Selwyn, without whose aid but slow progress in cataloguing would be possible.

“A large proportion of my time has necessarily been devoted to the examination of the collections brought in by the field geologists, the selection of material from these collections for microscopic investigation and the study of the thin sections when prepared. A great deal of work of a miscellaneous character has also been done, such as the examination of various stone implements to determine their material, and microscopic and blow-pipe investigations of rocks, clays and minerals handed to me at different times throughout the year.

“A series of 134 thin sections illustrative of the rocks associated with the apatite deposits in the Du Lièvre district, was prepared, and will shortly be reported on by Mr. Ingall and myself.

“The collection of Archæan rocks brought in this year by Mr. Tyrrell from the region between Lake Athabasca and the Churchill River was thoroughly gone over and forty-seven thin sections prepared for study.

“Twenty miscellaneous sections were also prepared, making the total number of microscopic sections prepared during the year, 201. The large and valuable collection of Archæan rocks brought by Mr. Tyrrell from Lake Winnipeg in 1890, is being reported on as rapidly as possible.

"The report on the rocks collected by Mr. Low from the Château Richer, Que., area has been completed and printed as an appendix to that gentleman's report. Several short papers have, with your permission, been communicated to the scientific journals.

"A cabinet of 84 drawers has been constructed in the basement, in which such rock specimens as are not needed for exhibition in the Museum, but which it is thought advisable to keep at hand for reference, are being placed.

"No field work of any extent was undertaken this year, but on the 18th of June I went to Montreal for a few days and collected a fine series of the nepheline syenite and other rocks from the Corporation quarry, this collection being subsequently supplemented by about 100 specimens from the same locality, presented by Mr. T. W. Chambers, of Montreal, who accompanied me during my visit.

"As this interesting locality will soon be practically inaccessible, it was thought desirable to obtain a full suite of these specimens for the Museum and also for use in distributing collections. Numerous letters inquiring about the scheelite found by me in Marlow, Que., last year, have been received and handed to you, showing the interest taken by manufacturers of iron and steel in the discovery.

"The property has been purchased by parties who intend commencing work in the spring.

"Some fine samples have been obtained by blasting on one of the veins this fall."

MINING AND MINERAL STATISTICS.

Of the work of the division of mineral statistics and mines under his charge, Mr. E. D. Ingall gives the following particulars :—

"From the date of the last summary, 31st December, 1891, the office work of the division has been carried out as usual, the time of the staff being occupied in collecting and compiling the statistics of mineral production and general information regarding the mineral resources and mining operations and discovery, as well as in answering inquiries for such information, and office routine.

"Mr. White's time was occupied in the office in plotting the field notes of his survey of the Kingston and Pembroke Railway mineral district, and in the compilation of the map of the same. He was also engaged in revising proofs of maps, and in other work in connection with the investigation of the phosphate district of Ottawa county, Que.

"During the summer season the field work prosecuted was as follows :—

" My own time was occupied from the middle of July until my return in the middle of November, in an examination of the new and important discoveries in the mining districts of West Kootenay, British Columbia. In returning, the following visits were made, viz., to the cinnabar deposit near Kamloops Lake; to Nelson and Vernon, B.C.; to the coal mines of Canmore, Anthracite and Lithbridge; and to Rat Portage, Ont., for the purpose of collecting general information regarding mining developments, and in connection with the organization of the work of the division.

" Mr. Brumell made a tour for the purpose of collecting general information regarding mining developments and discovery in Nova Scotia, New Brunswick, Quebec and Ontario.

" Mr. White was engaged in finishing the surveys for the before mentioned map, and incidentally in collecting statistics and general mining information.

" It may not be amiss to summarize the conclusions arrived at as a result of the studies prosecuted in the new mining camps of West Kootenay.

" As it was of course, impossible to properly examine all the mineral deposits known to exist in any of these districts in the time at disposal, selections were made which should, as far as possible, be illustrative of the different districts and varieties of deposits. The local features of these, as far as exposed by the developments made, were carefully studied and illustrative specimens for the museum were collected, together with samples for assay. In the camps tributary to Illecillewaet, on the Canadian Pacific Railway, visits were made to the older claims in the immediate vicinity of that place, as well as to the newer discoveries in the Fish River Valley and around Copper Hill. These comprise the following claims, viz.:—The Lanark, Maple Leaf, Isabella, Bluebell, Jumbo, Sanquahar and Cariboo, near Illecillewaet and the Gold Hill and Copper Hill group of claims. In the Fish River valley the chief points examined were the Elizabeth, Edinburgh, King Solomon, Herringback and Fishburn claims.

" In the Illecillewaet district proper, beyond some prospecting and assessment work little was being done at the time of my visit; but development work was being conducted by Messrs. Ryckman, M.P., and Scott and by Messrs. Fishburn & Co., in the Fish River valley. The general description of the Slocan veins given below will serve equally for those of the Illecillewaet and tributary districts.

" The Slocan district on the west side of Kootenay Lake was visited during September and October.

"These new discoveries, made in the fall of 1891 and spring of 1892, are situated about the headwaters of the Kaslo River, and between there and Kalso City on the west shore of Kootenay Lake. A number of discoveries were made later in the year on the shores of Slocan Lake between the Columbia River and Kootenay Lake. These could not, however, be visited, owing to lack of time ; and for the same reason it was found impossible to visit other discoveries in the Lardo River country and at various other points in the valleys of the Lower Kootenay and Columbia Rivers about which very glowing accounts came to hand.

"Kaslo was reached in the beginning of September, and after all necessary arrangements were made the trail up the valley of the Kaslo River was followed to Bear Lake, on the divide between that valley and the watershed of Slocan Lake and River, and trips were here made to the various groups of claims distributed along the route.

"Bear Lake was reached on the 19th of September, and an attempt made to reach the important group of mines on the surrounding mountains, but this purpose had to be temporarily abandoned, owing to the early advent of snow which effectually hid everything at that elevation. Whilst waiting for the melting of the snow, a short examination was made of the Ainsworth Camp for the purpose of comparing the conditions there with those of the Kaslo-Slocan camps, and thus connecting the work with that done by Dr. G. M. Dawson in 1890.

"The snow having melted sufficiently, the examination of the Kaslo-Slocan group was continued and most of the chief discoveries were visited. The return of the snow on the 10th of October, however, again prevented the study of the surface showings at the Bonanza King Claim, of which nothing could be seen but the tunnel. This was much to be regretted as it was the chief claim in the Noble Five Group, the discovery of which has led to the rush to the district, and indirectly to all subsequent discoveries. It was, however, yet found possible to see the Freddy Lee and Slocan Star mines on Carpenter Creek, owing to their being on a slightly lower level.

"In returning it was intended to visit the Wellington and White Water claims, but the snow having reached the lower levels, no further work could be attempted, and the return to Kaslo was made on the 15th of October.

"Much hopeful activity in the direction of prospecting and development work was manifest in this district, and not without foundation, high hopes were prevalent regarding its future.

" Towns were started at Nakusp and New Denver on the proposed wagon route for providing the Slocan claims with an outlet *viâ* the Columbia River line of steamers and also to Kaslo which is the terminus of the now completed wagon road, connecting with the Kootenay Lake steamers by which ore can be shipped to the smelting works in process of construction at Pilot Bay or to any point in the United States *viâ* Bonner's Ferry on the Northern Pacific Railway.

" In a preliminary report such as this it would be impossible to give the results of these investigations, other than in very general terms, and all the detail of the evidence upon which these conclusions are based will be left for the complete report that it is intended to issue later.

" However, of the geological conditions of occurrence of the deposits visited and of their visible extent, etc., the main features are given below.

" Proceeding west from Kaslo, the rocks noticed seemed to belong to two distinct series. A belt of green dioritic schistose and serpentinous rocks, following west north-west along the northern side of the valley of the Kaslo River, whilst south of these the rocks are for the most part black shales and slates with gray interbedded bands, which evidently consist for the most part of carbonate of lime. The general dark colour of this series of rocks, varying from dark gray to black, would seem to be due to the presence of carbonaceous matter, and is in striking contrast, both in colour and structure, with the general green colour and more metamorphic characters of the adjacent rocks to the north. The black shaly series are tilted, in places much folded, and also at times indurated. They frequently show local metamorphism, which latter phenomena will probably be found in all places, as it evidently is in some, to be due to the action of the intrusive igneous rocks which are visible as dikes and masses or areas, cutting both the before-mentioned series.

" The veins examined show in general the characters of fissures cutting the formation, although sometimes conforming along the strike with the inclosing rocks for considerable distances. Where occurring in connection with the calcareous bands of rock, there would seem to be a tendency to make large pockets in connection with the vein or towards widenings of the vein itself. Strippings on some of these present surfaces of considerable extent, which, however, on further development have proved not to belong to the veins proper, which, whilst generally found to be more persistent, are generally comparatively much narrower.

" Although they show variations in structure these fissures in general carry galena in ribs, nodules, etc., associated with an ochrey

gangue locally termed *carbonates*. This ochrey material is said to assay well in silver in many instances, it being doubtless enriched by the presence of more or less argentiferous carbonate of lead, or, as was plainly visible in some cases, by the presence of disseminated native silver and argentite, doubtless resulting as secondary products from the alteration of the argentiferous galena.

"The galena varies much in texture from a fine blue ore of steely grain up to coarse cube and sometimes shows a ribbed structure. With it in many cases are associated various arsenical and antimonial minerals of silver disseminated through the ore proper. The occasional presence of a certain amount of copper is evidenced by the stains of malachite and azurite, which probably originate from the weathering of the tetrahedrite as well as from copper sulphurets, which occur in slight degree. The general run of the reported assays of specimens from the district is high, averaging in the hundreds of dollars, and occasionally even reaching to the thousands, the latter results being quite possible for separate specimens when the presence of the richer silver minerals is borne in mind. At one mine which has made considerable shipments, it is claimed that these have averaged \$200 per ton, and the conclusions based on the general evidence obtainable would seem to justify the expectation that the yield of the district will be found to average high in silver.

"The galena-bearing veins which cut the green schistose and serpentinous rocks, present to the eye a generally similar appearance to those found in the shale and argillite series, except of course for the absence of the associated pockets of ore mentioned in connection with the calcareous bands.

"What may prove an interesting discovery was reported late in the season from the Whitewater basin, some prospectors having brought in specimens of quartz which, according to local assayers, averaged very high in gold. No further particulars are, however, available, as the intended visit to the place was prevented by the advent of the snow. It raises hopes, however, that these schistose rocks which resemble lithologically the gold-bearing Huronian of Eastern Canada may prove even richer in this respect than the latter, especially when the much stronger evidences of complete mineralization found here, are considered.

"Assuming then that, in actual working, the ores should be found in shipping lots to maintain their high content of silver, which would seem probable in most cases, a bright future may be predicted for this district if those interested will only observe and act on the financial and economic principles necessary to success.

"The completion of the wagon road from Kaslo into the centre of the district will be of great value in the working of the mines and the existence of smelters in Canadian territory at Pilot Bay, Revelstoke and Golden will doubtless prove of great assistance when a continuous supply of ore shall be forthcoming.

"The projected railroads to give connection with the Canadian Pacific Railway at Revelstoke, and from the Slocan divide to Kaslo, will doubtless be constructed when the veins are worked on a more extensive scale.

"The assays made of the selected specimens collected during the season show the following general results:—

"In the Illecillewaet district four assays of galena from different points varied between 18 oz. and 73 oz. of silver per ton, the pyritous ores of copper being found, in the one sample assayed, to carry silver also.

"The galenas of the Fish River sub-district gave results running from 39 to 318 oz. of silver per ton. A sample of the "ochreous" material locally called "carbonates" showed 692 oz., and some of the zinc-blende nearly 6 oz. of silver per ton.

"The assays of galena from the various veins in the Kaslo-Slocan district resulted as below:—For those occurring in green schistose and dioritic series of rocks, six assays gave results ranging from 38 to 146 oz. per ton, averaging over 90 oz. One assay of a specimen of zinc-blende showed silver to the extent of 26 oz. In the same district the galenas from veins occurring in the black argillite series of rocks averaged in some thirty-one assays, 150 oz. per ton, ranging from 30 oz. to 520 oz. per ton. Assays of zinc-blende returned from 26 oz. to 73 oz. per ton. The ochreous "carbonates" occurring with the galena yielded very variable amounts of silver, the lowest return being 20 oz., the highest 1,630 oz. per ton. This great discrepancy is due to this ore being a mechanical mixture only, which is often enriched by secondary deposition of native silver and the richer silver minerals. In the whole series of assays made, numbering some sixty-five in all, gold was absent, except for mere traces found in three cases.

"The ton referred to is that of 2,000 lbs. For further details see the forthcoming report of the Chemical Branch of the Department.

"The cinnabar deposit, on the north shore of Kamloops Lake near the mouth of Copper Creek, about six miles from the western end of the lake, was visited on the 26th of October.

"Here, owing to the recentness of the discovery, the work done on the veins has not been extensive, consisting only of shots and shallow pits on the outcroppings. The area visited was covered by the Rose-

bush Claim, in which several spar and quartz veins are to be seen, averaging about a foot or so in width; on these, at a number of points, very encouraging showings of ore have been exposed, justifying the hope that still better results might be achieved by extensive developments. The cinnabar itself occurs in such a manner in the gangue in ribs, etc., that by hand picking a high grade of ore can be easily selected, and no difficulty was found in procuring handsome specimens for the museum.

"At the coal mines at Anthracite, Canmore and Lethbridge work was proceeding much as usual, but there was no time to make any close study in what necessarily had to be a mere preliminary visit.

"For similar reasons at Rat Portage nothing more could be done than to ascertain in a general way the operations of the year, and to become acquainted with persons willing to give us information later. Whilst no mining proper was being done, several of the chief companies were erecting small mills to work their ores. The custom reduction works near the town itself had been idle for some time, owing, it is said, to the inadequacy of the plant to properly extract the metals from the ores of the district.

"Mr. White gives particulars as follows, of the work he prosecuted for the division in the Kingston and Pembroke Railway Mining District:

"The past summer was spent in completing the information for the map of the Kingston and Pembroke Mining District commenced last year. As the surveys of the older townships are very inaccurate, it was deemed advisable to run a few tie lines across the lower part of the sheet. Chained traverses were therefore carried across from the vicinity of Kingston to Perth and from Sydenham to Westport. All roads not on existing maps were surveyed with odometer and compass. The mines and openings in the southern part of Frontenac county and northern part of Leeds county were examined and their position fixed with regard to the side lines and end lines of the lots on which they are situated.

"The low price of phosphate and mica has temporarily checked mining and exploration in this section. The only mines at present operating are the Opinicon and Nicholson mines in phosphate and the Webster Foxton & Stirling in mica.

"The outline of the edge of the Cambrian and Cambro-Silurian rocks was traced out in detail across the lower part of the sheet. Numerous outliers of Potsdam sandstone were found in the northern part of Loughborough and Storrington townships, and western part of South Crosby showing that the Cambrian sea, at one time, covered the isthmus of gneiss that connects the main mass in Canada with that forming the Adirondack region, in New York State.'

"Mr. White left Ottawa on the 8th of June and returned the 25th of September.

"During the summer he was ably assisted by Mr. J. H. Featherston, third year student at McGill University.

"Mr. Brumell furnishes the following information, relating to his observations and inquiries in the districts he visited :

"I left Ottawa on the 13th July for New Brunswick, where the more important mining districts were visited and the lists of operators revised. Since my last visit a rather important deposit of manganese was found in South Albert county and prospecting had been carried on continuously in the neighbourhood of Herring Cove, Albert county, in search of a large body of copper ore supposed to exist there.

"During the past winter operations were suspended at the Britton Mine near Woodstock, it having proved to be of no value.

"The old established mining industries of the province, such as gypsum, coal, grindstones, granite and building stone, are being carried on as in previous years. At St. John the lime industry which in previous years attained considerable importance, languished in a measure on account of the enactment of the McKinley Bill in the United States.

"No work has been done on the nickeliferous deposits at St. Stephen.

"On the 1st of August I went to Nova Scotia and visited the principal mining districts along the lines of railway ; among others the gypsum quarries of Hants and Colchester counties, the iron mines of Pictou county, the Coxheath copper mine, Cape Breton, and others. Of new industries, the most important is undoubtedly that of iron smelting on the East River of Pictou, where at Ferrona and Bridgeville, two new furnaces have been erected, at the former place for the manufacture of ordinary pig, while at the latter only charcoal pig-iron is made.

"At Ferrona the 'New Glasgow Iron, Coal and Railway Co.' have an extensive plant, consisting of one stack of eight tons capacity, with the necessary appurtenances and thirty-six Belgian copper coke ovens. They have also built a railway twelve miles and a half long from the works to Black Rock. The Bridgeville works are owned and operated by the 'Pictou Charcoal Iron Co.,' and consist of one stack of twenty-five tons capacity, with necessary blowing plant, etc., and a range of twenty charcoal kilns. A siding has been laid to the works from the line of the New Glasgow and Intercolonial Railway.

"Operations at the Coxheath Copper Mines in Cape Breton were suspended during the year, and it is said that in the near future they will be reopened and operated on a large scale. The old established mining

industries, such as gold, coal, iron ore, gypsum and manganese, are being carried on as heretofore. This may also be said of building stone, granite, grindstones and mineral waters.

"In the province of Quebec I visited the asbestos district of Black Lake and Thetford, and the gold mines on the Chaudière and tributaries. Asbestos mining seems to have been somewhat overdone, the result being that several of the works are closed to enable the owners to dispose of heavy stocks which have been carried over; to do this there has been a very considerable decline in prices. In the Chaudière gold district work was progressing on the Gilbert River under the management of Mr. W. P. Lockwood, and development work was being actively carried on upon the Du Loup and Millstream, as well as in Ditton township further to the south-west.

"In Ontario I was engaged principally in correcting our lists of producers of structural and other mineral materials.

"Boring operations were being carried on as in 1891, over considerable areas in the south-western part of the province, notably in Welland and Essex counties, with very favourable results, large flows of gas having been found at several points. In Welland county oil had been found in two areas, the flow being from the Medina white sandstone.

"Mr. Brumell returned to Ottawa on the 7th of November."

The total cost of the season's explorations under the division of Mineral Statistics and Mines was \$3,665.

PALÆONTOLOGY AND ZOOLOGY.

Mr. Whiteaves reports that the fourth part of the first volume of 'Contributions to Canadian Palæontology,' was published in December last. It consists of a systematic and descriptive report, of one hundred and five pages octavo of letter press, illustrated by fifteen full page lithographic plates, "on the fossils of the Devonian rocks of the islands, shores or immediate vicinity of Lakes Manitoba and Winnipegosis," collected for the most part by Mr. Tyrrell in 1888 and 1889. Prior to the year 1890, not more than six species of fossils had been recorded as occurring in these rocks, but in this report as many as one hundred and thirty-three species are either identified or described.

A large series of Ammonites from the Cretaceous rocks of the district of Athabasca, collected by Mr. McConnell in 1889 and 1890, has been studied, and a paper descriptive of the species represented has been contributed to the 'Transactions of the Royal Society of Canada' for 1892. This paper will be illustrated by four full page quarto plates.

A paper entitled "Description of a new genus and species of Phyllocarid crustacean from the Middle Cambrian of Mount Stephen, B. C.," and illustrated by one woodcut, has been published in the 'Canadian Record of Science' (Montreal) for October, 1892. The specimens upon which this paper is based, were collected by Mr. McConnell in 1888 and by Dr. Ami in 1891.

The fourth part of the 'Contributions to Canadian Micro-Palæontology' was published in July, 1892. It consists of a paper on "Radiolaria from the Pierre formation of North Western Manitoba," by Dr. D. Rüst, of Hanover, Germany, who has made a life study of fossil Radiolaria, with a short introduction by Mr. J. B. Tyrrell, and is illustrated by three lithographic plates.

In Zoology, 462 specimens of birds and small mammals, from Indian Head, Assiniboia, have been received from Mr. W. Spreadborough. During the past year, Mr. S. Herring, the taxidermist to the Survey, has mounted nine specimens of mammals, eighty-three of birds and two of turtles, but most of these are intended for the Banff Museum. He has also cleaned and numbered the whole of the mounted specimens of mammals and birds in the cases in the Museum. The skin of the Pacific Walrus, referred to in last year's report, has been skilfully mounted at Prof. Ward's Natural Science Establishment at Rochester, N.Y., and is now on exhibition in the Museum. Among the more interesting specimens of native mammalia and birds received during the year are a magnificent example of the Wood Buffalo (*Bison Americanus*, var.) from the District of Athabasca or its vicinity, presented by Warburton Pike, Esq., the only specimen of the kind known to be preserved in any museum, and a pair of Whooping Cranes (*Grus Canadensis*) from near Prince Albert, Saskatchewan. While attending the meeting of the American Association for the Advancement of Science in August last, at Rochester, N.Y., Prof. Ward's establishment was frequently visited and numerous specimens of interest (especially a skeleton of the Bald Eagle and one of the Great Blue Heron) were secured for the museum of the Survey, either by purchase or in exchange.

During part of the time that the director was absent from Ottawa, on field work, the duties of acting director have devolved upon me and, in addition to the correspondence entailed thereby, about 150 official letters have been received and the same number, many of them of the nature of reports, written.

Mr. Weston reports that since the 15th of January last, most of his time has been devoted to museum work in the palæontological and

archæological divisions. He has arranged and classified many new specimens and incorporated them into their proper positions in the cases. He has labelled and developed many fossils for study and exhibition, and has superintended the mounting of various specimens. He has also prepared and examined many microscopical sections of rocks and fossils. During the months of July and August he spent a short time at Baie St. Paul, collecting specimens of garnetiferous gneiss, which were wanted for college collections, and obtained an interesting series of fossils from the Trenton rocks of the vicinity, among which are several species new to this locality. Part of these months were spent with Dr. Selwyn in investigating several features of the geology at and around Quebec City. Most of the exposures were examined and the details of their structure worked out. Dr. Selwyn and Mr. Weston succeeded in obtaining from the Mountain Hill escarpment, several species of fossils which have not previously been recorded from these rocks.

Dr. Henry M. Ami reports that during the earlier months of the year, as well as during the last two months of the same, his time was chiefly occupied in examining and determining the species of fossils from various collections in different provinces of the Dominion, which were entrusted to him. These organic remains range from the Cambrian to the Post-Tertiary. The intervening summer months, with the exception of four days spent at the meeting of the Geological Society of America, held at Rochester, N. Y., were chiefly devoted to the classification and arrangement of duplicates and to the preparation of collections for educational institutions. Of these the largest sent was a systematic collection of fossils which contained four hundred and sixty-six specimens of one hundred and fifty different species from various formations in Canada. This collection was labelled and forwarded to the Biological Department of the University at Toronto, Ont. Another collection of sixty-five specimens of Mesozoic and Tertiary fossils, was sent to the University of New Brunswick at Fredericton. These were duly acknowledged by the authorities concerned.

Classified lists of fossils were prepared for the field geologists from whose collections the specimens were identified, as follows:—for Dr. R. W. Ells—lists from Lot 20, R. VI., Stanbridge; Clarenceville; one-half mile E. of Lacolle; Missisquoi Bay south of Phillipsburg, Phillipsburg, Mystic, all in the province of Quebec; and of another extensive collection made by Dr. Ells and Mr. Whiteaves, at Phillipsburg and Mystic in August, 1890. Most of these fossils were difficult to determine but interesting. For Mr. Giroux—classified

lists of Cambro-Silurian fossils from the town of Joliette, Chaloupe River, near the bridge, seven miles N.E. of Joliette, Ste. Elizabeth, Ste. Ursule, Chicot River, St. Justin, St. Barthélemi, St. Cuthbert and other localities in the counties of Joliette and Berthier, in the province of Quebec. For Mr. Weston—A collection of typical Trenton fossils from Bay St. Paul, below Cape Tourmente, P.Q., and for Prof. Bailey, several collections from Lunenburg County, Nova Scotia.

The extensive collections of rocks and fossils made during the previous year (1891), in the Selkirks were unpacked and for the most part labelled. The fossil remains were studied and most of them identified. It is one of the largest collections of Paleozoic fossils yet obtained from the Rocky Mountain region of Canada, and the specimens will soon be placed in the show-cases. Material for the study of the graptolitic faunas, in which Canada is so rich, has been gathered together and will be determined and classified in so far as the mode of preservation and quality of the specimens warrant. Assistance in this work has kindly been promised by Prof. Charles Lapworth of the Mason Science College, Birmingham, Eng., who is the best authority on the subject. Several thousand duplicates have been arranged and classified during the past year and preliminary studies of several groups have been made for future use and reference.

Dr. Ami also reports having prepared labels for the Cretaceous plants collected by Dr. Hayden and himself at Canmore and Anthracite, N.W.T., and recently described by Sir William Dawson.

Mr. Lambe reports that during the past year he has been engaged in the critical examination of three separate collections of recent marine sponges, which are as follows, in the order in which they were examined :—

1. A large number of sponges (about thirty species) from the vicinity of Vancouver Island, B.C., dredged by Dr. G. M. Dawson during the summer of 1885, together with some dried specimens, representing four species, collected by Dr. Dawson in 1891, in Behring Sea.

2. Some entire specimens of marine sponges, with small portions of others, representing in all about twenty-two species, from the Redpath Museum, Montreal; also two or three sponges from the museum of the Natural History Society of Montreal, mostly collected in the Gulf of St. Lawrence and off the Atlantic Coast of Canada.

3. A large and important collection of sponges, dredged by Mr. J. F. Whiteaves in Gulf of the St. Lawrence during the years 1871-72 and 1873, and about six specimens of different species of sponges collected by Dr. G. M. Dawson in 1878, in the vicinity of the

Queen Charlotte Islands, B. C. The specimens obtained by Mr. Whiteaves were dredged at depths varying from twenty-five to 220 fathoms and represent about twenty species, for the most part preserved in alcohol.

From the 25th of January to the 24th of September, he devoted himself to a microscopic examination of the specimens in collection No. 1. He reported on part of this collection in a paper, entitled "On some sponges from the Pacific Coast of Canada and Behring Sea," which was read before the Royal Society of Canada in June last. This paper is illustrated by four plates, and will be published in the current volume of the Society's Transactions. He prepared microscopic drawings of such of the sponges in this collection as are not yet reported on, which he proposes to utilize in connection with their description at a later date.

On the 26th of September, he visited Montreal and spent two days in looking over the recent marine sponges from the Gulf of St. Lawrence and the Atlantic Coast of Canada in the Redpath Museum. Through the kindness of Sir William Dawson he was allowed free access to the cases and to borrow some type specimens, and such others as he thought would prove of particular interest, as well as small portions of nearly all the remaining sponges in the collection. Through the courtesy of the Council of the Natural History Society of Montreal, he was enabled to borrow two or three Atlantic forms from the museum of the Society.

The study of collection No. 2 engaged his attention from his return to Ottawa on the 29th of September until the middle of November. A number of hitherto undescribed forms are included in this collection, whose microscopic characters were thought of sufficient interest to warrant the preparation of a number of drawings.

From the 17th of November until the present date he has devoted himself to a preliminary examination of collection No. 3.

He hopes to be able to report on all the Atlantic and the remainder of the Pacific sponges included in these collections at an early date.

During the first part of January and from the 17th to the 22nd of September, also from the 10th to the 13th of December, he was engaged in helping to identify or ascertain the characters of certain species of Gasteropoda and Trilobita, in the collections of fossils from Lakes Manitoba and Winnipegosis made by Messrs. Tyrrell and Dowling in 1888 and 1889.

Drawings were prepared for their illustration, which are reproduced in plates xlv., xlvi. and xlvii. of part IV. of the 'Contributions to

Canadian Palæontology.' From the 27th to the 30th of June, and from the 12th to the 15th of July he made drawings of some Cretaceous plants, collected by Dr. H. M. Ami in 1891, at Anthracite, B.C., to illustrate a paper by Sir William Dawson for the current volume of the Royal Society's 'Transactions.' He also made a drawing of a Phyllocarid crustacean from the Middle Cambrian, of Mount Stephen, B.C., to illustrate a paper by Mr. Whiteaves for the October number of the 'Canadian Record of Science.'

Between the 3rd and the 11th of October, he prepared drawings for four plates, to illustrate Mr. Whiteaves's paper on Cretaceous Ammonites collected by Mr. R. G. McConnell in the District of Athabasca in 1889, which will appear in the volume of the Royal Society's 'Transactions' for 1892.

The number of official letters received by Mr. Lambe during the year is thirty-three and the number written is thirty.

The following is a list of specimens collected by officers of the Survey during the past year :—

Dr. R. Bell :—

About eighty specimens of fossils from the Cambro-Silurian rocks at La Cloche Island, Lake Huron, and two species of field mice, and a specimen of *Amia calva*, from that island.

Twenty-five specimens of fossils from the western part of the Grand Manitoulin Island.

Six slabs of ripple marked surfaces, associated with fossil-like forms from the Huronian sandstones of Aird Island, Lake Huron.

Hugh Fletcher :—

About sixty specimens of fossiliferous shales and quartzose rocks from West Advocate, Cumberland Co., N. S.

Portion of small trunk of *Calamodendron* from the conglomerates at the base of the Millstone Grit of Middle River, N. S., and obscure forms from the Devonian rocks at Kirkhill, P. O., Cumberland Co., N.S.

Prof. L. W. Bailey :—

Two specimens of *Astropolithon Hindi*, from Bedford, N. S.

About twenty-five specimens of fossiliferous Lower Carboniferous limestone from the "drift" of Hickman's Island, Lunenburg Co., N.S., and seventy specimens of fossils from Bear River, N.S.

Twelve specimens of fossils from the altered shales of Nictaux, N. S., one fossil from the iron mines of Moose River, N.S., and one from the Triassic sandstone of Digby Neck.

R. G. McConnell :—

Twenty-six fossils from the Palæozoic rocks of the Howse Pass and Saskatchewan River, and twenty-three from the Cretaceous rocks of the Red Deer River, Rocky Mountains.

J. B. Tyrrell :—

Specimen of a fresh water sponge (*Meyenia fluviatilis*) from Cree Lake, N.W.T.

Dr. H. Ami :—

About forty specimens of fossils from the Black River limestone, near Hemlock Lake, Beechwood, Ottawa.

T. C. Weston :—

Thirty specimens of fossils from Mountain Hill, Quebec City, and thirty-five from the Trenton limestone from Baie St. Paul, below Cape Tourmente, P.Q.

R. Chalmers :—

Fifty specimens of three species of shells from the Saxicava Sand of Lawrence Dock, and forty specimens of six species of fossils from the "boulder clay" at Negrotown, near St. John, N.B.

W. C. Willimott :—

Thirty specimens of two species of marine sponges, from Minas Basin, N.S.

J. White :—

About seventy-five specimens of fossils from various localities in the counties of Hastings and Frontenac, Ont.

W. J. Wilson ;—

Fifty-four specimens of thirty species of ferns from the Devonian rocks at the Fern Ledges, St. John, N.B.

The additions to the palæontological, ethnological and zoological collections in the Museum, by presentation, exchange or purchase, are as follows :—

By presentation :

Warburton Pike :—

Fine specimen of the Wood Buffalo (*Bison Americanus*) from the District of Athabasca.

E. E. Hazen Drury, St. John, N.B. :—

Six specimens of a *Unio* (*Unio Danae*?) and four casts of the interior of the shell of a species of *Viviparus*, from the Laramie formation thirty-five miles north of Calgary.

A. E. A. Lowes, Yorktown, N.W.T. :—

Skin of *Thomomys talpoides*, from Yorktown.

G. R. White, Ottawa :—

Mole Shrew (*Blarina brevicauda*) in the flesh.

James Macoun :—

Two skins, one of the fur seal (*Callorhinus ursinus*) and the other of the "hair" seal (*Phoca vitulina*, var.)

Alexander McInnes (per W. Maddin) :—

Thirty-eight slabs of fossil plants from the Carboniferous rocks of Nova Scotia.

E. W. Holt, Thorne Centre, Pontiac Co., P. Q. :—

Specimen of the Star-nosed Mole (*Condylura cristata*).

Colonel C. C. Grant, Hamilton, Ont. :—

Thirty specimens of fossils from the Clinton and seventeen from the Niagara formation near Hamilton.

John Stewart, Ottawa :—

Specimen of *Edrioaster Bigsbyi*, from the Trenton limestone of Hull, P.Q.

Garnet Watt, Aylmer, P.Q. :—

Stone dish, apparently of Eskimo manufacture.

Percy H. Selwyn, Rounthwaite, Manitoba :—

Skin of the Jack Rabbit or Prairie Hare (*Lepus campestris*).

Prof. James Hall, Albany, N.Y. :—

Series of casts of fossil bryozoa from the Devonian rocks of the State of New York, etc.

Alexander Whitney, Uxbridge, Ont. :—

Young Red-throated Diver (*Urinator lumme*) from Uxbridge.

W. Rogers, Ottawa :—

Young Snapping Turtle (*Chelydra serpentina*) from the Rideau Canal, near Ottawa.

D. Herring, Toronto :—

Male Summer Tanager (*Piranga rubra*) shot at Scarborough, Ontario.

H. S. Poole, Stellarton, N.S. :—

Four specimens of fossil plants from the Lower Carboniferous rocks of Centre Bridge, Pictou Co., N. S.

R. H. Campbell, Ottawa :—

Six species of Post-Tertiary fossils from Nepean, Ont.

By purchase :

From Dr. R. Jardine, Prince Albert, Saskatchewan :—

Pair of the Whooping Crane (*Grus Americana*).

From Ward's Natural Science Establishment at Rochester, N.Y. :—

Two mounted skeletons, one of the Bald Eagle (*Haliaeetus leucocephalus*) and the other, of the Great Blue Heron (*Ardea Herodias*).

By exchange :

From Ward's Natural Science Establishment :—

Fifty-six species of recent shells.

From Dr. Herman Jhering, Brazil :—

Twenty species of fresh-water and land shells from the Rio Grande do Sul.

From Dr. Arthur Dendy, Melbourne, Australia :—

Sixty species of marine shells from South Australia.

Mr. James Fletcher, in charge of the Entomological collections, reports as follows :

"The Entomological collections belonging to the Museum are in good condition. There have been no losses from accident, insect pests or fungi since I last reported to you.

"Several valuable additions have been made during 1892. Small collections were brought in from the field by Messrs. James Macoun, D. B. Dowling, J. McEvoy and W. McInnes. Donations have been received from Messrs. W. H. Danby, of Victoria, and C. DeBlois Green, of Nanaimo, B.C., from Mr. W. C. Adams, of Montreal, a small collection chiefly beetles, but containing also two specimens of considerable interest for the locality (Nova Scotia) in which they were collected. These were the rare Hawk moths *Lepisesia flavofasciata*, and *Smerinthus Cerisyi*. From Ottawa entomologists, we have also received several rarities. The rare moth *Erebus odora* was presented by Mr. Martin Griffin.

"The cabinet space is at present sufficient, but a little more will be required next year."

BOTANY, &c.

Owing to the continued absence, on special duty, of Mr. James Macoun, assistant in the botanical division, Professor Macoun's time has been largely occupied in the routine work of the division, and in editing part VI. of the Catalogue of Canadian Plants, which was completed and issued in July last. It contains 295 pages royal 8vo., and is a complete summary of our knowledge up to date of the Canadian mosses. The work enumerates 953 species and many varieties. Of these, 237 species are new to science.

A manual with figures and descriptions of the edible Fungi of Canada is in hand. The manuscript of the first part, Edible Mushrooms, will soon be ready. The plates are now being lithographed, and it is hoped the part will be ready to issue in the ensuing spring.

For reasons above referred to, the work on the Descriptive Catalogue of Canadian Birds, mentioned on page 87 of the Summary Report for 1891, has been interfered with, and another year will now elapse before it can be prepared for the printer ; but this may not be altogether a disadvantage, as in the meantime gaps in our knowledge of ornithological

distribution will probably be filled, thus adding to the completeness of the work when published. An examination of the bird skins collected in the autumn of 1891 by Mr. W. Spreadborough at Indian Head indicated that it would be desirable to send the same collector there again in the spring. He accordingly went there early in April and remained till the fourth week in July. During that time he collected over 400 skins of birds and some small mammals. Notes were made on the migration and the nesting habits of many birds which will be incorporated in the catalogue. Among the specimens collected is a complete series of the game birds and the hawks of the district. Many of these have been mounted and are ready to be placed in the museum proposed to be established at Banff.

Our knowledge of the birds of the Pacific coast and islands is very scanty, and before publishing any catalogue of these, it would be desirable to devote at least another summer to collecting and observing in that region. It is hoped this work will be undertaken during the ensuing spring and summer.

Professor Macoun strongly urges the necessity of better accommodation for the work of the botanical and natural history division, and points out that "the cramped quarters in which the work has to be done is even a greater hindrance to progress than the want of assistance." Unfortunately the limited capacity of the museum building renders it impossible under existing circumstances to obviate this evil, by which all the other divisions are also more or less injuriously affected.

MAPS.

Maps in course of preparation and maps published during 1892.

	Sq. Miles.
North-west Territory, Athabasca and part of British Columbia (3 sheets) 20 x 30 in. to illustrate work of Mr. McConnell, 1889-90, and reaching from longitude 110° to 120°, and latitude 54° to 60°, ready for engraver, scale 8 miles = 1 inch,	
Index of Map of the above, ready for publication, scale 48 miles = 1 inch.	
North-west Territory, country lying between Athabasca River and Lake, and Reindeer Lake, reaching from longitude 102° to 112°, and latitude 50° to 60°, in progress. (Messrs. Tyrrell and Dowling), scale 8 miles = 1 inch.	
British Columbia, Kamloops sheet (Dr. Dawson), ready for publication, scale 4 miles = 1 inch.....	6,400
British Columbia, Shuswap sheet (Dr. Dawson), in progress, square 4 miles = inch.....	6,400

	Sq. Miles.
British Columbia, Placer Mines of Cunningham Creek (Mr. Bowman) scale about $27\frac{1}{4}$ chains = 1 inch.	34
British Columbia, Quartz Veins and Placer Diggings, Grouse Creek (Mr. Bowman), scale about 25 chains = 1 inch.	14
British Columbia, Placer Mines of Antler Creek (Mr. Bowman), scale about 26 chains = 1 inch.	38
British Columbia, Lightning Creek (Mr. Bowman), scale 400 feet = 1 inch.	17
British Columbia, Williams Creek (Mr. Bowman), scale 10 chains = 1 inch.	12
The above (five) mining plans are in the engravers' hands and will shortly be ready for publication.	
Rocky Mountains, region lying between Howse Pass and Athabasca Pass (Mr. McConnell, 1892), in progress, scale 8 miles = 1 inch.	
Manitoba, Map showing the whole of Lake Winnipeg (Mr. Tyrrell), ready for engraver, scale 4 miles = 1 inch.	48,600
Northern Manitoba (part of) in progress (Mr. Tyrrell), 2 miles = 1 inch.	5,000
Northern Manitoba (Mr. Tyrrell), published 1892, scale 8 miles = 1 inch.	20,000
N. Eastern Manitoba, Lake Winnipeg, in progress, scale 8 miles = 1 inch.	20,000
Northern Ontario, Lake of the Woods, sheet No. 2, published 1892, scale 2 miles = 1 inch.	2,000
Northern Ontario (Hunters Island), sheet No. 7, published 1892, scale 4 miles = 1 inch.	3,456
Northern Ontario (north of Hunters Island), sheet No. 6 (Mr. Smith), in progress, scale 4 miles = 1 inch.	3,456
Northern Ontario, Sheet No. 9 (Mr. McInnes), in progress, scale 4 miles = 1 inch.	3,456
Ontario, Sheet No. 125 (South of Sudbury Sheet), Dr. Bell, in progress, scale 4 miles = 1 inch.	1,800
Ontario, Sheet No. 131 (Sheet, east of Sudbury), Mr. A. E. Barlow, in progress, scale, 4 miles = 1 inch.	3,456
Ontario, Sheet No. 115, ready for draughtsman, scale 4 miles = 1 inch.	3456
N. E. Territory and Northern Quebec, exploratory survey by Mr. A. P. Low, from Lake Mistassini to the mouth of East Main River, in progress, scale 8 miles = 1 inch.	
Ontario and Quebec, Sheet No. 121 (west of Eastern Townships, Map), Dr. Ellis, in progress, scale, 4 miles = 1 inch.	3,456

Quebec, N. E. $\frac{1}{4}$ Sheet (Eastern Townships Map), published 1892, scale 4 miles = 1 inch.....	4,500
Quebec, S. W. $\frac{1}{4}$ Sheet (Eastern Townships Map), ready for engraver, scale 4 miles = 1 inch.....	4,500
Quebec, N. W. $\frac{1}{4}$ Sheet (Eastern Townships Map), in progress, scale 4 miles = 1 inch.....	4,500
Quebec and Lake St. John district, $2\frac{1}{4}$ sheets, in progress (Mr. Low), scale 4 miles = 1 inch.....	6,912
Quebec, $\frac{1}{4}$ sheet 18, S. E. (Messrs. Bailey and McInnes), with engraver, scale 4 miles = 1 inch.....	3,456
Quebec, $\frac{1}{4}$ sheet 18, S. E. (Messrs. Bailey and McInnes), in progress, scale 4 miles about.....	500
Quebec, Lièvre River and Templeton phosphate region, Ottawa County, 2 sheets (Mr. Ingall), with engraver, scale 40 chains = 1 inch.....	220
New Brunswick, Surface Geology, $\frac{1}{4}$ sheets, 1 S. W., 1 S. E., and 1 N. E., 3 sheets (Mr. Chalmers), published 1892, scale 4 miles = 1 inch.....	6,650
New Brunswick, Surface Geology, $\frac{1}{4}$ sheet, 2 S. E., in draughtsman's hands, scale 4 miles = 1 inch.....	3,456
New Brunswick, Surface Geology, $\frac{1}{4}$ sheet, 2 S. W., in progress, scale 4 miles = 1 inch.....	3,456
New Brunswick and Prince Edward Island Surface Geology, $\frac{1}{4}$ sheet, 5 S. W., in progress, scale 4 miles about.....	1,500
New Brunswick and Nova Scotia Surface Geology, $\frac{1}{4}$ sheet, 4 N. W., in draughtsman's hands, scale 4 miles about.....	3,456
Nova Scotia, 16 sheets, 18 in. x 12 in. (Messrs. Fletcher and Faribault), with engraver, scale 1 inch = 1 mile.....	3,000
Sheets No. 1, 2, 3 and 4, of the above (16) sheets, are nearly ready for publication, scale 1 inch = 1 mile.....	500

LIBRARY.

During the year ended 31st December, 1892, the librarian, Dr. Thorburn, reports that there have been issued from the Survey Office 8,755 publications, consisting of reports, parts of same, special reports and maps; of these 6,207 were distributed in Canada, the remainder, 2,548, were sent to literary and scientific institutions in other countries, from many of which we have been receiving similar favours—thus adding year by year very materially to the library of the Survey.

The number of books, maps, pamphlets, &c., sent to the library during 1892, was 2,681, in addition to which 128 books were purchased, and 36 periodicals relating to scientific subjects have been subscribed for.

The number of letters and acknowledgments received during the year was 2,028, and the letters and acknowledgments sent out by the librarian amounted to 1,052.

The number of volumes bound during the year was 171. There are now about 9,500 volumes, besides about 3,900 pamphlets in the library. During the year, the space available for library purposes has been enlarged and it is found to be a great convenience for properly arranging and classifying the works pertaining to various branches of knowledge. It may be stated, however, that the annex added to the library is already nearly filled with the overflow of books which have been accumulating for years, and for which there was previously no room, except on the floor and ledges of the book cases. Care has been taken when opportunities occurred to complete imperfect sets of publications thus adding greatly to the value and usefulness of such works. The library now contains a very valuable collection of books and pamphlets, chiefly technical, on geography, geology, mineralogy, botany, zoology and other allied branches of natural science. The attention of the government has, on more than one occasion, been called by the director to the ever present risk of the whole Museum, with its immensely valuable treasures, being destroyed by fire. The rooms in the basement, where the surplus copies of the reports are stored, are so situated, that it would be next to impossible to save them in case of a serious fire, which may occur any day, in a building no part of which is fire-proof. The danger of this happening at any time is evident when we consider that neither is the Museum itself, nor are the buildings attached to it, fire-proof.

Sales of Survey publications for the year ending 31st December, 1892, amounted to \$243.94.

There are other outstanding amounts of sales, which have not yet been received, amounting probably to about \$2,000.

VISITORS.

The number of visitors to the Museum during the year from the 1st of January to the 31st of December was 19,550, or 813 fewer than during the same period in 1891.

In this connection I may be excused if I quote certain remarks which were made in the Summary Report for 1888, as follows:—

“In my Summary Report for 1885 I called attention to the question of opening the Museum on Sunday afternoons, and I then gave some very remarkable statistics of attendance, the result of this course having been adopted at the Australian Museum in Sydney, showing that on the 52 Sundays, afternoons only, the daily attendance was.

largely in excess of that of the 313 week days, the average being 986 on Sundays and 275 on week days ; such a fact needs no comment, and I venture again to express a hope, in the interests of education and knowledge, that the time is not remote when a similar experiment will be tried in Ottawa.

“ There will doubtless be strong objections urged against such action, based chiefly, if not entirely on the very erroneous, but unfortunately very prevalent idea, that a museum is a place of amusement, whereas it is essentially a place of instruction as is the church and Sunday school ; and the principal difference between the two, concisely stated, is, that in the museum the *work*, and in the church and school the *word*, of the *Creator* is expounded. This admitted, there seems no obvious or intelligible reason why the one establishment should be closed and the other opened on the Sabbath.”

Since the foregoing was written, I have sought opinions on this subject, and I have been much gratified to find such a large number of persons, including clergymen of various denominations, who regard the opening of the Museum on Sunday afternoons favourably, and think that to do so could not prove otherwise than advantageous to the community, and especially to that very large class of persons whose daily occupations leave them no time in which they can avail themselves of the valuable information and instruction which the Museum is designed to afford.

STAFF, APPROPRIATION, EXPENDITURE AND CORRESPONDENCE.

The strength of the staff at present employed is 56, viz ; professional, 36 ; ordinary, 20.

No changes have taken place in the permanent staff during the year 1892.

The amount available for the fiscal year ending 30th June, 1892, was :—

	Grant.	Expenditure.
	\$ cts.	\$ cts.
Civil list appropriation	48,310 00	
Geological Survey and Museum appropriation	60,000 00	
Artesian boring	3,485 52	
Civil list salaries		48,115 54
Wages of temporary employees		16,739 70
Exploration and survey		24,021 71
Boring operations, Deloraine		5,016 51
Printing and lithography		10,257 24
Purchase of specimens		340 39
Purchase of books and instruments		1,478 71
Purchase of chemicals and laboratory apparatus		240 35
Stationery, mapping materials and Queen's Printer		1,469 23
Incidental and other expenses		1,899 95
		109,579 33
Less—Paid in 1891		5,159 75
		104,419 58
ADD—Advances to explorers for 1892-93		7,107 73
		111,527 31
Unexpended balance, civil list appropriation		194 46
do Geological Survey appropriation		73 75
	111,795 52	111,795 52

The correspondence of the Department shows a total of 10,588 letters sent and 6,830 received.

I have the honour to be, Sir,

Your most obedient servant,

ALFRED R. C. SELWYN,

Deputy Head and Director.

GEOLOGICAL SURVEY DEPARTMENT
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR

SUMMARY REPORT

ON THE

OPERATIONS OF THE GEOLOGICAL SURVEY DEPARTMENT

FOR THE YEAR 1893

BY

THE DIRECTOR

PUBLISHED BY AUTHORITY OF PARLIAMENT



OTTAWA

**PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S
MOST EXCELLENT MAJESTY**

1894

SUMMARY REPORT
OF THE
OPERATIONS OF THE GEOLOGICAL SURVEY DEPARTMENT
FOR THE YEAR 1893.

4th January, 1894.

The Hon. T. MAYNE DALY, M.P.,
Minister of the Interior, Ottawa.

SIR,—I have the honour to submit herewith the annual summary report of the executive work, and of the scientific investigations undertaken by the staff of the Geological Department during the year ending 31st of December, 1893. The progress of the work generally has been fairly satisfactory, while in some directions it will, it is hoped, have afforded much valuable, important and interesting information respecting the geography, physical characters and natural resources of two of the most extensive areas of practically unexplored country in the Dominion, viz., the Labrador peninsula; and the western coast of Hudson Bay, or the country which lies between Athabasca Lake, Chesterfield Inlet and Fort Churchill. It may be mentioned that both these explorations were commenced in 1892, and a statement of the result attained that year is given on pp. 12-19 and pp. 32-33 of last year's summary report. It seemed desirable that the work should be continued this year. Instructions were, therefore, given at an early date in 1893, to Mr. J. B. Tyrrell and to Mr. A. P. Low to take whatever steps were necessary to ensure the success of these explorations with, in both cases, the probable contingency provided for, of not being able to return before the summer or fall of 1894. Mr. Tyrrell left Ottawa early in May, and, up to the present date, only one brief communication and a box of fossils collected on his way north have been received from him. The letter is as follows:—

FOND DU LAC, 27th June, 1893.

DEAR SIR,—In coming from Fort Chippewyan to here we followed the north shore of Lake Athabasca, making as good a survey with the boat log as the time would permit. We were delayed very much by storms, but we managed to make the journey in seven days.

The country presents many interesting features. The sandstone occurs on the north side of the lake in several places, and green Huronian schists were seen about the middle of the west side, and also largely developed at the north end of Black Bay. The point south-east of Black Bay consists of a massive quartz porphyry, and south-east and east of it is a wide belt of white quartzite and conglomerate occupying the shore for about twenty miles. Near the east end of this outcrop of Huronian quartzite is an extensive deposit of limonite and hematite. The point where this deposit was seen was in a hill 125 feet high, the scarped faces of which stand out boldly as high red cliffs. The whole hill is a mixture of quartz and iron ore. The deposit is a very interesting one, and I was very sorry to be obliged to leave it and rush on. However, I have collected a pretty full set of specimens which will give some idea of this ore deposit, and of the shore in general. These specimens I am now sending back from here.*

We are now starting for the Barren Lands, and by the time that this letter reaches you, I hope that we shall have crossed to Hudson Bay.

With kind regards,

Yours sincerely,

(Sgd.) J. B. TYRRELL.

From the foregoing it seems probable that Mr. Tyrrell will pass the winter either at Fort Churchill or at the Hudson Bay Company's post on Reindeer Lake. If the latter, we may expect to receive some communication from him during January.

Since writing the above, on the 2nd January, the following telegram was received from Mr. Tyrrell:—

WEST SELKIRK,

1st January, 1894.

Complete success; crossed barren grounds; explored Chesterfield Inlet and west shore of Hudson Bay.

On the 8th of November, the following interesting letter, dated Rigolet, 5th October, was received from Mr. Low:—

DEAR DR. SELWYN,—I am sending with this a preliminary report of my season's field work. From it you will see that we reached Ungava, 27th August, after a summer of very hard work, in fact, the hardest that I have ever experienced, but as every one was in good health, it was not unpleasant. The most important discoveries made were:

1. The immense deposits of Cambrian rocks along the Ungava River. These closely resemble the rocks along the east coast of Hudson Bay, and I believe they cover a great area of country about and to the

*The specimens referred to have not yet arrived, 20th January, 1894.

westward of Ungava Bay. They are essentially an iron-bearing series, as almost every bed holds that metal, and some of them are pure hematite ore.

2. Evidence that the continental ice cap took its rise in the interior of Labrador, and flowed outwards from a gathering ground in the vicinity of the headwaters of the East Main River.

3. That the interior of Labrador is everywhere well wooded, and that the old opinion that it was a treeless wilderness no longer holds.

On arriving at Fort Chimo, I found the natives there in a most deplorable state, owing to the absence of deer last winter, and to the failure of the Hudson Bay Company's agent to supply their needs, as a consequence between 200 and 300 died last winter, and the small remainder are in a state of abject poverty. Such being the case, I considered it inadvisable to send provisions inland, as they would probably be stolen. The stock of pork at the post was also not sufficient to supply the wants of my party, and as the work can as advantageously be carried on from Hamilton Inlet, I resolved to proceed there on the Hudson Bay Company's steamer.

My provisions have been shipped to North-west River post at the head of the inlet, and I leave here on the 8th inst. for that place.

As regards future operations, I at present propose to immediately send my men up the Hamilton River and the canoes, with instructions to take them as far as the Grand Falls portages if the ice will permit. They will remain there until they can return to North-west River on foot, and will then be employed drawing in provisions on the ice, so that by open water in the spring, next season's outfit will be well inland, thus leaving the summer free for exploration in the interior. I at present propose to return by one of the rivers flowing into the gulf, unless I can find a route from Hamilton River to Michicoon, in which case I might descend the Big River to James' Bay, but this is improbable, as there is a wide interval to cross wholly impassable without a guide, and a guide there, I think, cannot be found, as the people at Nitcheguon had no knowledge of Hamilton Inlet. During the early winter, Eaton and I will be employed writing a report on this season's work and plotting the surveys made. After Christmas, I hope to avail myself of the kind offer of Mr. Wilson, to accompany him on his official visits to Cartwright and Davis Inlet; in so doing I will get a fair knowledge of the rocks along the coast between these places.

Mr. Eaton, in the meanwhile, will accompany the men and carry the survey up the Hamilton River to where we are to commence canoe work in the spring. As the mail arrives here early in April, I will

await its arrival, and will then start inland for the coming season's work.

Mr. Eaton has proved an excellent assistant, and has performed all his duties in a highly creditable manner.

I remain, dear Dr. Selwyn,

Yours sincerely,

A. P. LOW.

It is thus seen that Mr. Low is now wintering at Rigolet, the Hudson Bay post in Hamilton Inlet, on the east coast of Labrador. Whether he will be able in the spring to make his way west by the Big River waters to James' Bay, thus crossing the whole Labrador peninsula about twenty degrees of longitude, or whether he will be obliged to turn south to the St. Lawrence Gulf, is at present uncertain.

Including the parties under Messrs. Tyrrell and Low above mentioned, there have been sixteen separate explorations carried on during the year as follows:—

British Columbia.....	3
North-west Territories.....	1
Eastern Manitoba and Keewatin.....	1
Ontario.....	4
Quebec.....	2
East Main River and Labrador.....	1
New Brunswick.....	1
Nova Scotia.....	3

Summary statements of these explorations are presented herewith. The work accomplished is almost entirely in continuation and extension of that of previous seasons in the several districts, and it has considerably advanced the preparation of the geological maps which are being published in uniform sheets, as rapidly as the surveys and investigations required for their completion can be made.

No work has been done during the year in connection with the well at Deloraine, but a sum of \$408.72 has been paid the committee since the 1st of July last, on account of the wages and of work due at that date, and a further small balance is still due. The arrangements for placing a pump on the well mentioned, page 6 of last year's report, unfortunately fell through. It was hoped that the Canadian Pacific Railway Company would undertake the work, and it was only on the 18th of October, 1893, that I received intimation that they could not do so. Further effort will, however, be made in the spring to settle this very important question of water supply in Western Manitoba. I was at the well on the 29th of June, and found the water then standing in the six-inch pipe at sixty-one feet from the surface.

What the actual supply might be can, of course, as already stated, only be ascertained by pumping. Tenders for the work might be asked for, and it should be commenced as early as possible in the spring. In view of the heavy cost of fuel, and other expenses incidental to the use of a steam boiler, the pump should, I think, be operated by a wind mill.

The analysis of the water was given on p. 6 of the summary report for 1892, the solid contents being then 447·255 grains per imperial gallon. It is, however, quite likely that this defect will be greatly lessened by continued pumping.

In the summary report for last year, page 8, some particulars were given respecting the annual report, Vol. V., for 1889-90-91. During the entire year much of my attention has been devoted to the work of correcting the proofs, and the details of editing this large volume of 1,567 pages, Rvo. with maps and illustrations. It is now published in two parts, and the first complete copies were received from the printers, Part I. on the 28th of November, and Part II. on the 16th of December.

Since the above was written the following very satisfactory communication has been received from Deloraine:—

DELORAINÉ, Man., 16th January, 1894.

DEAR SIR,—Replying to your letter of the 13th, received to-night, the engine started pumping at about 10 o'clock on the 10th instant, and worked continuously night and day until Sunday night. I wired Gen. Supt. Whyte to send out an expert, and he came Sunday afternoon. The pump was started again at midnight Sunday to let Mr. A. C. Frith, the expert, off on the Monday morning train. I forwarded a sample of the water to Mr. Whyte on Wednesday, and Mr. Frith took one immediately the pump started Sunday night, another sample two hours later, and another sample at 8 o'clock when the train left. When the pump was first started the sand and mud came for twenty-four hours, and the water became warmer; on Saturday night it was 70°, to-day it is 80°. The pump never stops as we want to test it thoroughly. It smells and tastes to me very much like the Banff hot spring water, this morning especially. I called the attention of a man who went to Banff sick some time ago to the water as it was going into a barrel for some one in the village, and asked him what he thought of it, and he immediately replied, Why, that is Banff water sure.

There does not appear to be the least decrease in the supply. There was a terrible famine for water and sheer necessity made the water man try to use the water with the happy result. It has a slight, salty

taste, but is not as strong as when first used, and every one is drinking it, and although not pleasant at first, get used to it, and it has no bad effect, it is very soft and does splendid in the boiler. All the cisterns in the village were filled up last week, and now we have a length of pipe and run it out on the street between Montgomery's store and the Revere House, and it is flooding the street and makes fine skating for the school children. It does seem good to see this continued stream of hot water running day and night. The farmers come in from the country and take it away in tanks the cattle like it so well. I cannot express to you how pleased I am and everybody else. After so many years' work at it and no result, I never went anywhere without having to stand all kinds of jokes, but it is all right now. I knew it was a white elephant to the department, and I wish now to put you and Mr. Daly especially, in shape to defend the big expenditure, which I always felt was a serious matter as long as no results were obtained, but now every one says the money was well spent, because those in any other part of the country who want to do the same have the knowledge of the Deloraine well, and with it before them a very large amount can be saved by knowing exactly how far they will have to sink, and start from the beginning accordingly. The success of the Deloraine well has been my ambition from the commencement, and I am amply repaid. And your many kindnesses, and also those of Mr. Dewdney and Mr. Daly, who were always willing to help it along, M.P. or Minister, I shall remember and look back upon with the bright side upward. I shall only be too pleased to do anything I can in the way of information, and hope you will not hesitate to give me a chance to do what you may require.

No steps have yet been taken about caring for the water, but there is to be a meeting of the village ratepayers to-morrow afternoon.

Very sincerely yours,

A. P. STUART.

Dr. A. R. C. Selwyn,
Ottawa.

From the above it appears that the improvement I have above referred to is already taking place. A fresh analysis will be made as soon as a sample of the water which has been sent for, is received.

The executive details of the department, matters connected with the Chicago Exhibition, and some special geological examinations which I made in the North-west, entailing visits to Deloraine, Banff, Anthracite, Morley, Calgary and Edmonton, have fully occupied my time and attention during the year now closed. Between December, 1892, and November, 1893, 129 days were spent in Chicago, superintending the

installation of the exhibits, and later on giving information to the numerous inquirers respecting Canada and its mineral resources, and in the duties incidental to the position of one of the judges in the mining department. The exhibit made by the Geological Survey of Canada was highly commended, and eight separate awards were granted it as follows :—

1. Collective exhibit of minerals, rocks and fossils.
2. Placer gold and nuggets.
3. Collective exhibit of coal.
4. Coal, bituminous sand and tar.
5. Marbles and building stones.
6. Maps and sections.
7. Photographs of trees framed in their own woods.
8. Collection of medicinal herbs, barks, &c.

To meet the expenses connected with its preparation in Ottawa, and a large part of those incidental to its installation and its superintendence during the exhibition, from the 1st of May to the 31st of October, a sum of \$4,000 was placed at my disposal by the Department of Agriculture. The balance of the expenditure incurred on this account, \$2,786, has been paid from the appropriation for Geological Survey purposes, making a total of \$6,786.

In this sum none of the salaries of the officers of the department, the whole, or part of whose time during the year was devoted to exhibition work, are included.

The undermentioned members of the staff of the Survey were at Chicago for the periods stated, and I have no doubt that the opportunity thus wisely afforded them of becoming acquainted with the aspect and character of the minerals, their associations and geological relations, in the many and widely separated regions from which they were gathered together at the World's Columbian Exposition, cannot fail to be most instructive and beneficial in connection with the prosecution of the future work of the Survey in Canada, which they may be called on to undertake.

	Days.		Days.
Dr. Selwyn..	129	Mr. Lambe.....	14
Dr. Bell.....	14	Mr. Chalmers.....	10
Dr. Ells.....	16	Mr. Brumell.....	44
Mr. Tyrrell.....	7	Mr. White.....	16
Mr. McConnell.....	8	Mr. Faribault.....	11
Mr. Low.....	17	Mr. McInnes.....	16
Mr. McEvoy.....	8	Mr. Giroux.....	21
Dr. Ami.....	21	Mr. Willimott.....	214
Mr. Ingall.....	16	Mr. Selwyn.....	245
Mr. Ferrier.....	19	Mr. Esdale.....	145
Mr. Dowling.....	13	Mr. Barlow.....	18

The following extract from the *New York Engineering and Mining Journal*, vol. LXVI., No. 26, 24th December, 1893, may be appropriately quoted in the present summary report on the work of the Survey during 1893 :—

THE DOMINION GEOLOGICAL SURVEY.

“ A display of minerals covering the resources, geology and physical aspect of the entire Dominion of Canada was made by the Canadian Geological Survey, under the immediate charge of the veteran director, Dr. Selwyn. As may be imagined the exhibit was made with great scientific exactness, and a careful study by the visitor will enable him to gain a good idea of the geology as well as of the minerals of scientific and economic value throughout the length and breadth of the Dominion. We have already passed in view the displays made by the several provinces, but these, as they should, made prominent the metal and mineral upon which each province may depend for commercial advantage. The general exhibit therefore very happily filled out any missing numbers in the series and presented a continuous mineral story from one ocean to the other.

“ In a number of flat cases, the style adopted in the museum at Ottawa, appeared suites of specimens neatly trimmed and labelled. The specimens were arranged first geologically and then subdivided with reference to geology ; thus under Laurentian were in one row all the gneisses of Nova Scotia ; on another those of Ontario, and another those of the North-west Territory. The collection in all comprised 1,500 specimens, and was especially prepared for the exposition by Mr. Walter F. Ferrier, of the Geological Survey. The whole collection will form a part of the cabinet collections in the museum of the Survey at Ottawa. In connection with this a palæontological collection containing many fossils of extreme beauty and rare interest was exhibited. *Eozoon Canadense*, which has caused so much contention among geologists, was illustrated with great completeness. This fossil was shown not only in connection with the minerals associated with it, but by means of drawings of microscopic observations and by photographs.

“ As a rule maps are prepared with so little regard for popular taste that they are passed unheeded. Two charts of the Dominion, however, prepared by the Survey and showing the occurrence of economic and precious minerals, caught the eye of nearly every sightseer. Most prominent on these maps was the great Alberta coal field, in the North-west Territory, which in extent seems to outdo the bituminous fields of Illinois. The gold district of the Fraser in British Columbia, and the valley formed by the St. Lawrence River and Lakes Ontario

and Erie, seemed to have varied and extensive mineral deposits. In both sides of this valley are to be found coal, petroleum, iron, etc., and the belt projects beyond the mouth of the St. Lawrence River over into the districts of New Brunswick and Nova Scotia, where the occurrence of gold and coal has established important mining industries. There was also shown a map geologically coloured, from which was apparent the extent of the great areas of the earlier rocks in Canada, especially the Laurentian and Huronian; sectional maps showed the work of survey expeditions to the Yukon region, the Lake of the Woods and other points. The Survey in all has some thirty men out this year on sixteen expeditions of this kind. Among the most important may be mentioned the party which takes in the Athabasca region of the North-west Territory, and another the British Columbia gold country up to the Alaskan boundary. Special surveys are also being carried on in Manitoba, in Quebec, in Nova Scotia and in New Brunswick. The Ontario survey covers the Algoma, the Sudbury, the Kingston and the Lake Simcoe districts. Some excursions, like that through the North-west Territory to Lake Athabasca, remind one of a Polar Expedition, so far as duration and expense are concerned. The geologists started on this 4000-mile journey from Ottawa in June of this year, and will be absent for a year, with a chance of not returning at all, the country being very wild. The maps exhibited are the result of these surveys. As soon as a party returns to Ottawa its members immediately devote themselves to the presentation of the data secured in the form of charts and maps, and the organization of the specimens into museum collections.

"A special exhibit of the gems and precious stones of Canada was made by a private firm in Montreal. In this the agates were particularly beautiful, and when cut and polished in jewellery form exhibit beautiful surface appearances and markings. Jade, tourmalines, albites, sodalite, quartz-asteria were among the other choice and rare gems native to this rich mineral country.

"In the line of economic minerals, phosphatés and building stones headed the list. The specimens showed the many varieties of phosphate mined and a corresponding diversity in colours. The apatites ranged from a deep green to a light pink in colour. A series of pictures above the cases of exhibits illustrated the outcrops of phosphate veins and the methods of mining as practised in Canada. A small trophy of building stones in cubes showed the characteristic limestones and marbles. The most beautiful specimen was one of mottled serpentine and dolomite ranging from pale green to pure white. A cross section of the so-called fossil trees found in Potsdam sand-

stone, near Kingston, was on exhibition. These trees were discovered to be simply concretions in sandstone, although they are perfectly cylindrical in shape, are many feet in diameter, and look like great petrified tree trunks when brought to daylight in the quarry. Canadian plumbago and its uses were illustrated by the commercial exhibit of the Walker Mining Company, which showed both the crude and manufactured articles. Several specimens taken from the quarry show 36 per cent of pure carbon in the shape of disseminated graphite. A number of pictures and photographs arranged along the top of the cabinets gave an idea of the Geological Museum as it appears in the Government building at Ottawa. There were also a number of views of phenomenal geology, such as exposed beds of polished and crumpled gneiss, and pictures of the inspiring mountain and mining scenery of the Dominion.

"This excellent showing of the geology, lithology and mineralogy of the Dominion was undertaken by the Dominion Survey at the request of the Minister of the Interior, Mr. T. Mayne Daly, and in the hands of the veteran geologist, Dr. Selwyn, director of the Survey, possessed, of course, great scientific interest, and presented many new features of Canadian geology. The collections were made up principally of new materials brought in recently from the fields and from duplicates in the Ottawa Museum, and were arranged by Mr. C. W. Willimott, assistant curator, Mr. W. F. Ferrier, lithologist, and Mr. P. H. Selwyn. The fossils were prepared and arranged by Dr. H. M. Ami, palæontologist. The maintenance of the exhibit in Chicago was in charge of Dr. Selwyn and his able assistants, Mr. P. H. Selwyn and Mr. C. W. Willimott."

From the beginning of the present year and until the month of August, Dr. G. M. Dawson was engaged in London and Paris on work connected with the preparation of the British case in the Behring Sea arbitration. This work related chiefly to the geography and natural history of the Behring Sea region, which had already been examined into by Dr. Dawson when acting, in 1891, as one of Her Majesty's Commissioners to Behring Sea. On the 20th of August, Dr. Dawson returned to Ottawa. A portion of his time has since been occupied with official duties during my absence in Chicago, but his attention has been chiefly devoted to dealing with arrears of work connected with the geology of British Columbia and to the preparation of a report on the geology of the Kamloops region, which has been now unavoidably delayed for several years.

While in London, Dr. Dawson read a paper on the mineral wealth of British Columbia, at one of the evening meetings of the Royal

Colonial Institute, which has since been published in the Journal of the Institute, and has already led to a number of inquiries as to the present prospects of mining in that province.

During the early part of 1893, Mr. McEvoy was engaged in plotting and compiling the work done in the previous season in the country embraced by the Shuswap sheet of the southern interior of British Columbia, the position of which is more fully described in the summary report for 1891, p. 17 A. Some time was also spent in selecting suitable specimens to represent the rocks of British Columbia in the stratigraphical collection prepared for the Chicago Exhibition.

In June, Mr. McEvoy was instructed to examine the country in the vicinity of the boundary of the southern part of Alaska.

He reports on the season's work as follows :—

“Leaving Ottawa on the 7th of June, Port Simpson was reached on the 22nd. Here two canoes, sent from Peterborough, were found ; for the transport of these I am indebted to the kindness of Mr. King, in charge of the British contingent of the Alaska Boundary Commission.

“Proceeding northward from Port Simpson up Portland Canal (as named on late charts) the shores were found to be composed of mica-schists and gneissic rocks, resembling those of the Shuswap series of the Selkirk Mountains, and possibly Archæan. These rocks continue to the mouth of the Nasse River.

“Above this point along Observatory Inlet the bedding becomes more obscure in the gneisses and at a distance of eight miles up they are replaced by granite.

“The rocks of Observatory Inlet are throughout chiefly granite, except near the head of the Alice Arm and over a considerable area around the junction of the Alice and Hastings Arms, where black, slaty argillites and sandstones are developed. This latter area is probably Cretaceous ; but no fossils were found in it.

“The upper parts of the inlet contain some valuable spruce and hemlock timber.

“Portland Canal was next examined. The chief characteristics of this inlet are the general uniformity of its width and the straightness of its shores, which are flanked by uniformly steep mountains. It is well named by the Indians ‘Kō-lau,’ which signifies ‘house.’ The predominating rock in this inlet also, is granite ; but gneisses and mica schists, with some grayish and greenish schists, appear for some distance on the east side of the upper part.

“The southern portion of the peninsula separating Portland Canal from Observatory Inlet, is composed chiefly of granite-gneiss like those

"Latitude observations taken with a seven-inch-sextant were obtained at various points. During the season 300 miles of track survey was made in canoes, and 230 on foot, necessitating 800 miles of travel."

The cost of the season's work, including salary of assistant, was \$1,884.18.

Mr. McEvoy was assisted by Mr. R. B. Eaton. He returned from the field on the 23rd of October, and has since been engaged in plotting and compiling the season's work.

After returning from the field, the 1st of November, 1892, Mr. R. G. McConnell was engaged for three or four months in completing and seeing through the press, his report on a portion of the district of Athabasca (Part D, vol. V., Annual Report, 1889-90-91). The remainder of the winter season was occupied in compiling a geological section through the Rocky Mountains, along the Howse Pass, from the data collected during the preceding summer. A section along the Bow and Kicking Horse Pass has already been published (Part D, vol. II., Annual Report, 1886), and other sections through the more available passes are in contemplation. When these are completed, important progress will have been made towards a proper understanding of the complicated structural geology of these ranges of the Rocky Mountains.

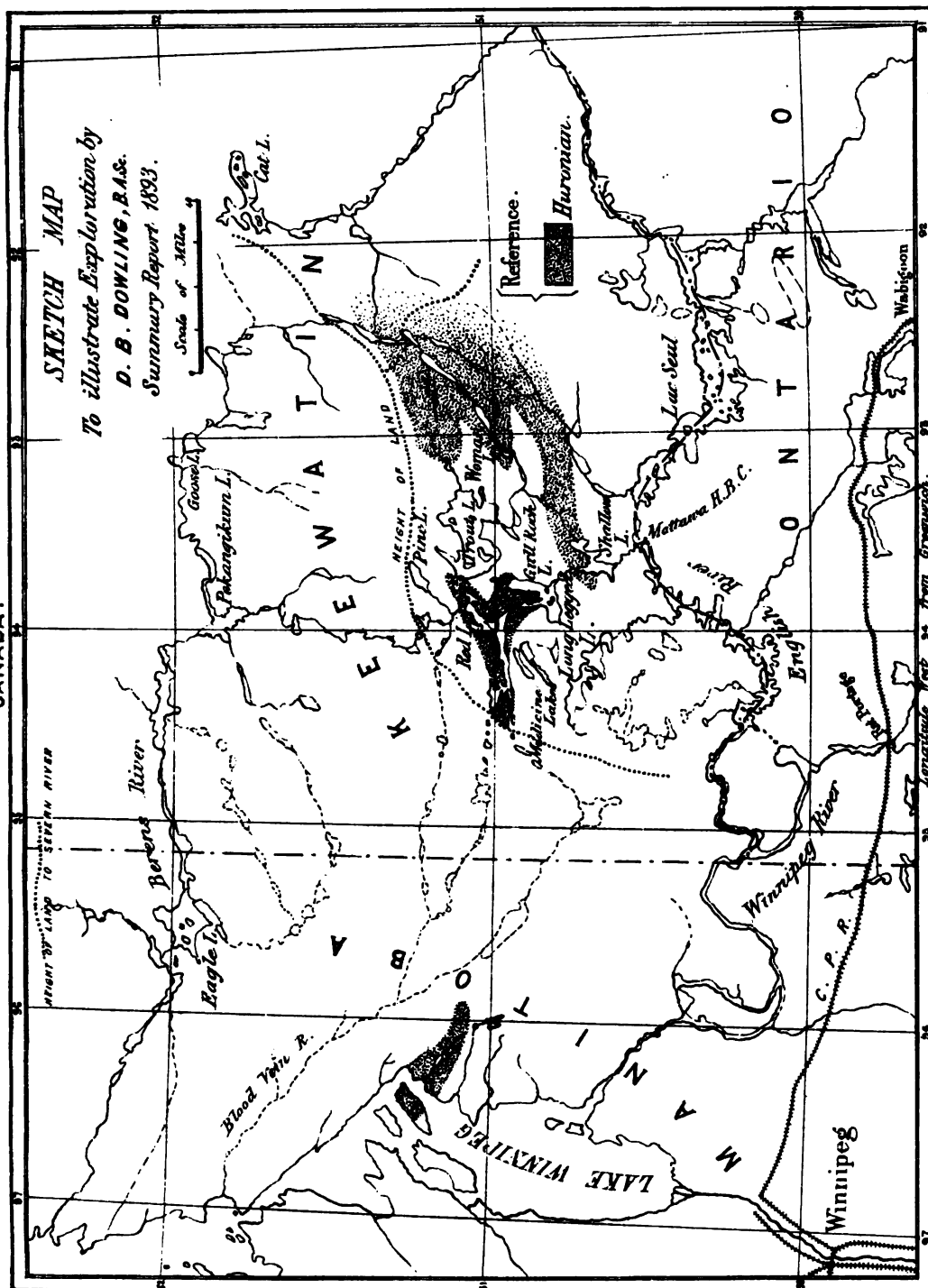
Preparations for taking the field again were begun in April, and on the 4th of May, Mr. McConnell left Ottawa with instructions to make a geological exploration of the Finlay and Omenica Rivers in the northern part of British Columbia. On this work he reports as follows:—

"We arrived at Quesnel on the 24th of May, a few days having been spent at Chicago on the way west, in an examination of the geological and mining and mineral exhibits at the Columbian Exhibition. Owing to difficulties in getting experienced canoe men and transport for our supplies to Fort McLeod, we were delayed for some days at Quesnel, and it was not until the 9th of June that we succeeded in getting away. The party consisted besides myself, of Mr. H. Y. Russell, from the Geological Survey Office, who acted as topographer, and four canoe men, two of whom were Indians. The delay at Quesnel proved most unfortunate, as in the meantime, the Fraser, up which our way led, had risen to its spring level, and the difficulty of ascending it was greatly increased. The men, however, proved both capable and willing, and in ten days' hard work we passed safely through the cañons and worst part of the river and arrived at Fort George. At this point one of the Indians, frightened at the length of the

SKETCH MAP

*To illustrate Exploration by
D. B. DOWLING, B.A.Sc.
Summary Report 1893.*

Scale of Miles 4



Autographed by C. U. Senécal, C.E.



journey ahead of him, shammed sickness, and I was obliged much against my will to leave him behind, as he had shown himself an excellent canoeman. A Fort George Indian was engaged to take his place, and after a day's delay we proceeded up the Fraser to the Giscome Portage, where we arrived on the 23rd of June. At the Giscome Portage we left the Fraser, crossed over the Arctic Pacific watershed to Summit Lake, the source of one of the branches of Peace River.

"The Giscome Portage to Summit Lake is seven miles and a half across, and we were occupied nearly three days in carrying over our canoes and outfit.

"From Summit Lake we followed a chain of small lakes connected by short, crooked, and at times exceedingly rapid streams, down to McLeod's Lake.

"Fort McLeod, situated on the northern end of the lake, was reached on the 28th of June. We expected to meet the pack train from Quesnel here with our summer supplies, but it had been delayed by the incessant rains, and flooded condition of the rivers, and did not arrive until a week later.*

"While waiting we fitted up a canvas canoe and we also made a couple of short excursions into the neighbouring hills. Our provisions arrived at Fort McLeod on the 5th of July; on the next day we started down the McLeod's Lake River and the Parsnip, and on the 7th reached the Peace.

"The water in the Finlay branch of the Peace being still high, I decided to wait a few days before commencing its ascent, and to spend the time making a hasty examination of the mountains along the Peace River pass through the Rocky Mountains. The range was here found to have the same structure as that which characterizes it further to the south, the mountains are built of westerly dipping beds, mostly limestone, but also including shales, quartzites, and conglomerates, ranging in age from Triassic down to Lower Cambrian. The beds are repeated several times by overthrust faulting; along the eastern edge of the range the Devonian-Carboniferous limestones have been thrust up over the Cretaceous sandstones and shales, and in going westward several similar faults are met with. Near the western edge of the range a high overthrust fault cuts through the western slopes of Mt. Selwyn, and has resulted in placing the Lower Cambrian quartzites, conglomerates and shales over Upper Cambrian limestones.

*A sketch map on a scale of five miles to one inch was made by Dr. Selwyn of the whole of this route from Quesnel *via* Fort George and the Giscome Portage to Fort McLeod, in 1875, and thence to Peace River, and is published in the Geological Survey Report for 1875-76.

Other evidence of the tremendous eastward shove to which the range has been subjected, is afforded by the crushed and contorted condition of many of the mountains.

"After returning from the Peace River we moved our supplies up the Finlay to the mouth of the Omenica, *cached* most of them there, and proceeded up the latter stream. In the first thirty-five miles the Omenica has a fall of from 400 to 500 feet, and its current flows with almost torrential rapidity. Two cañons occur in this reach. The lower or Black Cañon is situated about five miles above the mouth. At this point the river is confined for about half a mile between nearly vertical walls of gneiss. Near the upper end a huge rock rises in midstream in the already narrow channel and by partially blocking it causes a wild rapid when the river is in flood. It was at this point that Butler, in 1873, lost his canoe. About twenty miles further up a second cañon, known as the Little Cañon, was met with, but its navigation is comparatively easy.

"A few miles above the Little Cañon the grade suddenly lessens, and thence upward for many miles the Omenica meanders with a gentle current from side to side of a wide, flat bottomed valley.

"We reached Germansen Landing, forty-five miles from the mouth, on the 21st of July; a short trip was made from this point to Germansen Creek and Manson Creek; very little gold is now being obtained from these two creeks, and the mining population, once numbered by thousands, has dwindled to about fifteen. Gold is obtained both from the river bars and from the glacial gravels underlying the boulder clay. The former have been worked out, to a large extent, but only the richer portions of the latter have been touched, and when cheaper communication with the outside world is effected, they promise to become of considerable value.

"We returned to the Omenica on the 23rd of July, and proceeded up to Old Hogem, which we reached on the 26th. The current in this part of the river is easy, until within a few miles of Hogem, where swifter water is met with. The valley ranges from half a mile to a mile in width, and is bounded on both sides by mountains from 3,000 to 4,000 feet in height. From Hogem I made a trip on foot *via* Vital and Tom's creeks to Tatla Lake, a distance of about forty-two miles, while Mr. Russell continued up the river for some distance. Vital Creek was the first paying creek struck in the Omenica district, and the discoverer, Mr. Vital, with a couple of other men, was found still at work on it, although very little gold is now being taken out. Tom's Creek or New Creek was not discovered until 1889, it paid very well for two seasons, but is now also nearly exhausted. From fifteen to twenty men were employed on it during the past summer.

About \$100,000 is reported to have been taken out of it since its discovery.

"The rocks exposed along the Omenica consist at the Black Cañon of gneiss, mica schists, quartzites and limestones. Resting on these but apparently confined to the valley of the stream are soft conglomerates, shales and sandstones, holding plant remains either Cretaceous or Tertiary. Further up hard unfossiliferous limestones were met with. These are succeeded by gneisses and mica schists, followed by shales, quartzites and conglomerates, evidently belonging to the Bow River series (Lower Cambrian), and then by limestones again. The latter probably belong to the Castle Mountain group of the Rocky Mountains: above these and exposed all along the river from below Germansen Landing to New Hogem is a great series of green rocks, distinctly foliated in places, but often passing gradually into a massive eruptive looking variety. Interbedded with it are bands of dark shales, limestone, serpentines, and in one place a red magnesite. At New Hogem granites come in and are exposed along the river as far as Old Hogem, and for a couple of miles along the trail to Vital Creek, when they are replaced again by the green and dark schists. The latter are then exposed all along the trail until the valley of Tatla Lake is reached; when Cretaceous conglomerates and sandstones succeed and continue to the lake. The green and dark shales constitute the gold-bearing rocks of the district.

"After finishing the examination of the section through to Tatla Lake, I returned to the Omenica, and Mr. Russell having already arrived, we immediately commenced the descent of the river and reached our *cache* at the mouth, on the 3rd of August. Preparations were then made for the ascent of the Finlay, and on the 5th of August our long journey up it was begun. The water, though still moderately high, had fallen several feet, and some of the bars being exposed, we were enabled, much to the relief of the men, to replace to some extent the pole by the tracking line. The current for some distance above the mouth of the Omenica is moderately easy, and good progress was made. Further up swifter water was met with, and some trouble and danger was experienced in getting round the numerous drift piles lining the banks. On the 8th of August we reached Fort Grahame, a small fur trading post belonging to the Hudson Bay Company.

"We remained there a couple of days for the purpose of climbing the neighbouring mountains, and obtaining all possible information from the Indians about the upper part of the river. Their knowledge of the river as far as the forks was fairly correct, but above that became very vague. On the 12th of August we recommenced our journey and on the 13th came to the In-gin-i-ca River or south branch of

the Finlay, a stream about 125 feet wide ; it has not yet been explored. On the 15th we reached the Little Cañon, the Deserter's Cañon of Arrowsmith's map of 1854. A portage of half a mile was made here. From the Little Cañon to the Forks, a distance of about sixty miles, the river continues its north-westerly course following closely the western base of the Rocky Mountains. The Forks or the junction of the Finlay and Qua-da-cha (white waters) was reached on the 21st of August. At this point the Finlay River leaves the great valley which it has followed from its mouth, and which separates the nameless ranges bordering it on the west from the Rocky Mountains, and turns abruptly westward. The valley continues and is occupied by two tributaries of the Finlay, the Qua-da-cha and the To-chi-e-ca. The former soon turns eastward and heads in a great glacier situated near the summit of the Rockies ; the latter heads in two small lakes about forty-five miles north of the Finlay.

"A short distance further on in the same valley is another lake from which according to Indian report the waters of the Turnagain or Black River, a tributary of the Liard, issue.

"After leaving the valley just referred to, the Finlay cuts through the range to the west and then again turns north-west. The current becomes much swifter, and about twelve miles above the To-chi-e-ca the valley narrows to a cañon, we continued up the cañon for about four miles and then landed in order to examine a dangerous looking rapid just ahead, a portage proved to be practicable here, but as the cañon seemed to be of great length, I judged it better to camp, and explore it throughout before proceeding further, as the Indians reported it unnavigable. Our most experienced canoeman was sent forward for this purpose and returned with an adverse report. Although I had some doubts as to the accuracy of this report, I deemed it advisable, as the men all showed great unwillingness to proceed further with canoes, to endeavour to explore the remainder of the river on foot. A valley led off to our left in a westerly direction and I hoped by following it up to strike the river again above the great southerly bend, which I had been informed the Finlay made near its head.

"The canoes and outfit were *cached* and on the 25th of August we started over land, and after three days hard tramping over windfalls, through muskegs and ice cold mountain streams, we had the satisfaction of again reaching the river, having cut off by our march through the mountains about half the distance. Two of our men were sent back here, while with the remainder I continued on up the river,—here a long succession of rapids and cañons—and in half a day reached the south end of Lake Tchutade.

"Lake Tchutade (narrow water between mountains) is seldom more than 200 yards wide, and is simply an enlargement of the river. Walking along it proved extremely difficult, owing to the fallen timber and dense underbrush, and after proceeding up it for a few miles, I decided, as the lake followed the strike of the rocks and little geological information could be obtained by going further, to climb the mountains bordering the lake on both sides and then return. Mr. Russell ascended the eastern range, while I crossed the lake on a raft and climbed the range on the opposite side. From the elevation reached the narrow lake could be seen for a distance of about fifteen miles. The valley then divided, one branch turning eastwards, while the other bent to the south-west. I should have liked to have followed up the latter, as it may contain a second lake, but the state of our supplies did not admit of it.

"Lake Tchutade must have been originally much wider, but has been silted up and reduced to river-like proportions by the materials brought down from the glaciers which crown many of the neighbouring mountains. It occupies a rock basin, probably produced by an elevatory crustal movement near its outlet.

"We commenced our return journey on the 30th of August, and reached the canoes late on the following evening. On the 1st of September we descended the Finlay to the mouth of the To-chi-e-ca. The Indian route to Dease River, and the Stikine which follows up this stream was explored by Mr. Russell for some distance, and on the way back a short excursion was made by the writer into the Rocky Mountains. We reached the mouth of the Finlay on the 14th of September.

"The geological section afforded by the Finlay is much inferior to that on the Omenica. For the first 150 miles it follows the strike of the neighbouring mountains, and shows occasional sections of the gneisses and mica schists of which they are built. Numerous sections of conglomerates and plant-bearing shales and sandstones similar to those found on the Omenica above the Black Cañon are also exposed along this part of the river. After bending to the west, the Finlay cuts through green schists, and then in apparently conformable descending section through limestones and calc-schists (Castle Mountain Group), quartzose shales and conglomerates (Bow River series), and gneisses and mica schists probably Archæan. The latter rest on and dip away from coarse grained granite and diorites, the eastern boundary of which follows the western shore of Lake Tchutade. The green schists are probably a continuation of the gold-bearing schists of the Omenica, but if so the band becomes much narrower towards the north.

"Gold was found along the Finlay and on all the streams coming into it from the west, in some places in sufficient quantities to deserve the attention of the prospector. It would be impossible, however, to indicate these places, until a map has been prepared. No gold was obtained from the streams flowing from the Rocky Mountains above the Little Cañon. The section of country drained by the Finlay has never been prospected to any extent, owing to the difficulty and expense of access to it, and the same may be said of the greater part of the Omenica country also. I have little doubt, judging from the gold indications met with in the hurried explorations of the past summer, that if easier and cheaper communication with the outside world was opened up, paying gold districts would be discovered, and this is a matter which well deserves the attention of the provincial authorities.

"We returned from the Finlay by the Parsnip, McLeod Lake and Crooked rivers, reaching the Giscome Portage on the 24th of September. The run down the Fraser was made in three days, and we arrived at Quesnel on the 30th of September, and at Ottawa on the 20th of October.

"Cost of season's exploration, \$2,642.60."

Mr. Dowling was occupied during the early part of the year plotting the surveys of the preceding season and compiling a map, on a scale of eight miles to one inch, of the country included in the explorations of Messrs. Tyrrell and Dowling in the Athabasca district during 1892. This is in manuscript form and in the hands of Mr. Barlow, chief draughtsman, to be published with the report of the exploration. It embraces the country included between the 54th and 60th parallels of north latitude, and the meridians of 101° and 112° W. longitude. It is noticed by Mr. Barlow in a subsequent page of the present report. In the latter part of April, Mr. Dowling was requested to prepare for an exploration in the southern part of the district of Keewatin and eastern Manitoba, east of Lake Winnipeg, a hitherto wholly unexplored area included between that part of the Beren's River already explored, on the north, and Winnipeg River, and its northern branch, the English River, on the south. Of the headwaters of the southern branch of Beren's River and Blood Vein River, comparatively little was known, even by report, and the present season's work was directed mainly to exploring the southern and eastern branches of the Beren's River, and locating the headwaters of the eastern branches of the Blood Vein River.

In order to obtain information in regard to the best means of reaching the district and obtaining supplies, Mr. Dowling communicated with the officers of the Hudson Bay Company in charge of trading posts

in that vicinity. Mattawa, a winter trading post on the English River, below Lac Seul, was recommended as being the most accessible and centrally located point from which to begin the explorations northward. Supplies were therefore shipped from Rat Portage to Wabigoon Tank on the Canadian Pacific Railway. Two canoes were also ordered from Peterborough and shipped to the same point.

Of the season's work Mr. Dowling reports as follows: "On the 29th of May I left Ottawa for Winnipeg *via* Chicago, where I remained thirteen days in order to study the very large and varied geological and mineralogical exhibit of the several states and foreign countries in the Mines building. On the 15th of June I reached Winnipeg, where I was joined by Mr. J. C. Gwillim, a student of applied science, McGill University, who had been nominated as my assistant for the season. We proceeded to Rat Portage, where canoe men were hired, and on the 22nd of June, the party started northward from Wabigoon. The distance to the first lake on the canoe route is about nine miles and is now made by wagon. The road passes over two ridges, which rise to about one hundred and eighty feet above the lakes between which they form the watershed. They appear to be principally composed of well-rounded boulders, with pebbles and gravel; their summits are narrow and trend in a north-east and south-west direction. Other ridges of a similar kind were seen north of Shallow Lake. The route to Lac Seul leads through Sandy Lake, Minnetakie Lake, and several others on the upper waters of the English River, previously explored by Drs. Selwyn and Bell in 1872.* The geological features proved interesting as a great part of the route is through an area of Huronian rocks. We arrived at Lac Seul post on the 26th of June, where we hired the only available man who was acquainted with the route from Mattawa to the Beren's River. There seems to be little travel through this country, even by the Indians, and the man we engaged knew but one route.

"Before we reached Shallow Lake we were fortunately overtaken by some Beren's River Indians, and one of these was hired to guide us by their short route. We subsequently returned by the one known to our Lac Seul Indian.

"Our course was briefly as follows:—From the western end of Lac Seul we descended the English River about ten miles to the Mattawa River, up which we turned. Five miles brought us to Shallow Lake, which is about ten or twelve miles long in a northward direction. At its northern end two streams enter, the eastern one from Little Shallow Lake, into which the waters of Trout Lake River flow. The

*Geological Survey Report, 1872-73, pp. 87, 111.

other stream drains Red Lake and other fair sized lakes, Keg Lake and Gull Rock Lake. We ascended Red Lake River, making three short portages to Keg Lake, where the rock is a red slightly foliated granite. On the next lake, Gull Rock Lake, there are inclusions of the darker rocks of possibly Huronian age in the granite, and the western shore is mainly composed of these rocks, which continue to Red Lake. On entering Red Lake we turned north and ascended a small stream, coming in at nearly the extreme north-east corner of the lake. This stream was followed through Little Red Lake and then, much diminished in volume, through several smaller lakes to the height of land. Two portages, with an aggregate length of two miles and a half, with a small intervening lake, brought us to the White River, or rather a lake out of which a small stream, the source of White River, runs. This we followed down, making a number of short portages and turning around innumerable sharp bends until it had increased in volume to a fairly navigable stream with a straighter course. It joins the southern branch of the Beren's River at Pekangeikum or Dirty Water Narrows Lake. Here is an Indian Reserve on which we saw several houses and on a small island near by, a patch of potatoes.

"Our course thus far had been pretty nearly north from Red Lake. We now turned eastward ascending this branch of the Beren's River, passing through Sturgeon Lake which is about seven miles long with an average width of one mile. The river above this lake has several heavy falls at which everything is portaged, while there are other rapids which are not too rough to pull up by line. A series of three lakes is next reached, the first being Goose Lake on which formerly the Hudson Bay Company maintained a small trading establishment. Next is Fairy Lake, and then a second Goose Lake. Shortly above these lakes a small stream coming from near Cat Lake joins the river. We, however, followed up the southern branch till we portaged about a mile, to a long lake called Shaboomene, the waters of which flow eastward to Cat Lake River. From the extreme southern end of Shaboomene Lake we crossed by the Woman portage a mile long, to a series of lakes. The largest, called Woman Lake, draining to Shallow Lake by a stream joining the Trout Lake River.

"From Red Lake north to Beren's River and eastward as far as we went on that river, Laurentian gneiss and granite only were seen. On the first large lake south, previously mentioned as draining to Cat Lake River, dark green schists similar to the Red Lake rocks make their appearance and are continuous southward through a number of lake stretches and through Woman Lake. Woman Lake is the largest in this basin, and is about ten miles long. In the southern part a deposit of magnetite was noticed on a small island. This might be

of some future value except that the quantity appears to be limited by the size of the island which is a mere rock. The stream draining Woman Lake is at first broad and deep with little current to Little Bear Lake where the schists, etc., give place to and are succeeded by granite. The nature of the country then changes somewhat, the hills are rough but of an even outline and lower elevation, a marked difference from those bordering the lakes where the rocks are of a more varied composition. South-westward from Little Bear Lake the stream contracts with several falls and rapids, at which four portages are made. Snake Lake, a small expansion of the river, was next crossed. Below it the river enters a gorge with many rapids and falls, past which we portaged a distance of half a mile. The fall, in that distance, as measured by aneroid, being fifty feet.

"Shortly below this the stream joins Trout Lake River. Our provisions being exhausted, we could not visit Trout Lake. We therefore pushed on to Mattawa, where we expected a supply forwarded by the Hudson Bay Company from Lac Seul. Trout Lake River below this becomes much larger, running in an average south-west direction till it empties into Little Shallow Lake. The rock exposures are very few in this part of the river, owing to a greater accumulation of morainic material. At all but the lowest rapid or fall, however, the rock is exposed and is generally a dark gray and green hornblendic and micaceous schist resembling that on the lower part of Red Lake River and on Shallow Lake, and is probably a highly altered band of the Keewatin rocks. Several large dykes or masses of red granite are found to cut these and are most conspicuous at the rapids. The lowest rapid is caused by an accumulation of boulders in the channels, which are derived from a gravel ridge through which the river has cut its channel at this point. Below this the river is quite straight and apparently deep. It enters Little Shallow Lake at its northern end and leaves it at the north-west corner. On the 1st of July we reached Mattawa, where we found some supplies stored for us. Mr. Gwillim was sent with one canoe and two men to Rat Portage for some other provisions which we needed, that the post on Lac Seul had not been able to supply. I took this opportunity to make a trip to Red Lake to study the rocks of that basin and to make a log traverse of its shores. Red Lake is of a very irregular shape and may be described as lying about east and west in a trough of Huronian rocks. It has a length of twenty-five miles with an average width of two miles. Dr. Bell makes fuller mention of it in pp. 5-6 of the summary report.* Mr. Gwillim returned on the 31st July, and the whole party proceeded to Trout Lake

*Geological Survey Report, 1882-3-4.

of which I made a log traverse and careful examination of the rocks. The Huronian areas both to the east and west were expected, from their strike, to be found on some parts of this lake, but only fragments of the dark rocks included in gneiss and granite were observed. Trout Lake is the largest sheet of water in this district; it is sixteen miles long and about eight broad. The shores, more particularly of the southern part, are thickly strewn with boulders, and the surrounding hills, except a high ridge running parallel to the south-west shore are not of any great elevation. The top of this ridge is a series of closely joined hills steep on their northern face and more gradually sloping to the south, averaging about two hundred and seventy feet above Trout Lake and 1,575 feet above sea. The material composing them appears to be a mixture of sand and boulders all well rounded. The ridge on its summit is mostly of boulders and is probably of morainic origin. It was observed by us pretty continuously from the first rapid on Trout River, to the west end of Trout Lake, and by Indian report extends northward to Mikiam Falls on the Beren's River, where we made a portage over a high ridge of sand and gravel with a few boulders.

"To the south-west of this ridge, in several places, large areas seem to be covered with stratified beds of sand. On Gull Rock Lake exposures of sand occur showing a thickness of twenty to twenty-five feet. At Mattawa the sand gives place to light clay interstratified with sand, and affords better soil for gardens than further north. On Lac Seul several exposures of sand with thin clay partings are seen in the neighbourhood of the Hudson Bay Company's post, and immediately south across the lake a steep cliff of sand which was not visited, appears to be much higher than the rest, possibly rising to eighty or one hundred feet.

"From Trout Lake I went with light canoes to the eastward, crossing the Woman Lake area, finally portaging to a small stream flowing to the western end of Lac Seul. Following this down we reached Mattawa on the 17th of August. We found the Huronian rocks of the Woman Lake area to extend further to the east, and from their strike they may possibly reach Cat Lake River. The southern limit is crossed on the stream about fourteen miles north of Lac Seul, and is about east and possibly a continuation of the belt which touches the northern and western end of Shallow Lake, making this a much larger area, though not as varied a section as the Red Lake trough. In the meantime, Mr. Gwillim was sent to make a log survey of Little Shallow Lake, and the western shore of Shallow Lake and collect specimens from the several rock exposures; this he successfully accomplished and arrived at Mattawa on the 16th of August.

"Having travelled all the routes known to our guide, I returned to Lac Seul and discharged him, endeavouring to get a man that knew the country further west. The one obtained professed to know the country south and west of Red Lake, and we therefore started westward going down the English River to Maynard's Lake, going up a river at its west side to a series of three lakes joined by short river stretches or narrows. The name Long Legged Lake is given to this group. After making a survey of the whole we tried to find a way across to Red Lake to the north, but missed the road and as we were likely to lose too much time we returned by the English River to Mattawa, thence to Gull Rock Lake, where we tried another route to the west through Stoney Lake to the two Medicine Lakes lying between Long Legged Lake and Red Lake. The portage of Long Legged Lake was found and paced across. Then by a small stream flowing north we reached Red Lake.

"In the meantime, Mr. Gwillim was completing the survey of a lake north of Gull Rock Lake, the position of which we fixed by bearings from the high ridge south of Trout Lake. This would therefore connect the surveys round by the Trout Lake River and Trout Lake with that up Red Lake River. A small lake or extension of the north-eastern part of Red Lake was also examined and surveyed by Mr. Gwillim previous to joining us on Red Lake. A few days were spent examining a route by a chain of lakes to the south-west of the western extremity of Red Lake before completing the work of the season.

"Of the timber seen during the travels little need be said. South of Lac Seul white and red pine was frequently seen in small groves, and on the lake a few patches only. A few trees of red pine were seen on Red Lake, but none further north. Cedar was noticed in small quantity to the height of land, but none further north.

"The country in the vicinity of the headwaters of the southern branch of Beren's River is generally sandy and covered by a thick scrub of jack pine.

"We left for Lac Seul on September the 20th, and arrived at the Hudson Bay Company's post on September the 25th, where our accounts were made up and guide paid off. We arrived at the end of the Portage to Wabigoon Tank on Friday evening, September the 29th, and had our baggage taken across by team on Saturday. The canoes and heavier camp equipments were stored in the warehouse on Sandy Lake, the rest at the store at Wabigoon Tank. Arrangements were made with the officers of the company to ship the smaller canoe to Rat Portage, to be repaired, so as to be of some use for another season. October the 2nd was spent in Rat Portage, paying off the men and making up accounts with the Hudson Bay Company. I

arrived in Ottawa on October the 5th, and have since been engaged plotting the various surveys made during the season.

"Observations for latitude were taken wherever possible, to check surveys, also bearings on the sun near the horizon for variation. About thirty-seven photographs of interesting geological features were taken, and a series of 149 specimens of rocks collected.

"Of the geological results of the present exploration it will be seen from the accompanying sketch map that a very large and long branch of the Beren's River has been found extending much further to the east and south than was previously known or mapped. The eastern limit of the waters flowing westward by the valley of the Beren's River is very nearly 92° W. long., while the southern limit of the basin is in the latitude of $51^{\circ} 15'$ N. This therefore adds to our knowledge of this river, a branch which with its tributaries forms perhaps the largest part of the river, giving a total length of 260 miles from its mouth to its eastern source. The headwaters of the Blood Vein River are also found at a remote distance from its mouth, and show that this river flows in a valley extending south-east to a distance of one hundred and twenty miles from Lake Winnipeg. Of the geological features the most important is the discovery of a large area of Huronian rocks lying to the eastward of Trout Lake. The eastward extension of this area has not yet been defined, and it may cover a large area."

Cost of the season's exploration, \$1,511.16.

—Mr. McInnes's work during the past year has been entirely devoted to the completion of the surveys and observations made by himself and the late Mr. Smith, in 1892, with the object of perfecting for the engraver and for publication the two sheets, No. 6 and No. 9, of the Ontario series of geological maps on a scale of four miles to one inch. These sheets cover an area of 6,912 square miles west of Thunder Bay between the $48^{\circ} 30'$ and $49^{\circ} 15'$ of north latitude and between the $89^{\circ} 15'$ and $92^{\circ} 30'$ of west longitude.

From January to May, Mr. McInnes was occupied in plotting, reducing and compiling the surveys that had been made during the summer, as well as all available Crown Lands and other surveys, also in studying and working out the notes made by Mr. Smith and himself in reference to the geological structure of the areas that had been examined. In doing this it was found that some further surveys and examinations were needed to complete the work on sheet No. 6, but that as these were not extensive they could be easily taken up during the summer in connection with the work still required for the completion of sheet No. 9.

Mr. McInnes left Ottawa for the summer's work on the 26th of May; sixteen days were spent, en route, at Chicago.

Mr. Wm. Lawson, B.A., of Toronto, was engaged as assistant for the season. He had already spent several seasons in this field and his services were consequently of great value. He commenced work on the 9th of June, and first completed a micrometer and compass survey of the route from Lankoping station on the Canadian Pacific Railway across to Dog River and thence by Dog Lake and the Kaministiquia River to the north line of the township of Ware, a distance of about sixty miles. Between the 22nd and the 29th of June, and while Mr. Lawson was so engaged, the time was spent by Mr. McInnes in an examination of the Matawin River, where considerable prospecting for iron ore has been done. Mr. McInnes found that much work in the way of stripping and sinking test pits, etc., had been done on various locations and that deposits of magnetite of great thickness, but largely interbanded with cherty and jaspery layers, had been discovered.

An interesting conglomerate band occurs at two points on the river. It shows waterworn pebbles of cherty black slate quartzite, etc.

July the 1st to August the 5th was spent in the examination of a route through Windigoostigwan and Crooked Pine lakes, the Aticokan River, Steep Rock Lake and Seine River, returning to the railway at English River, by way of Turtle Lake, etc., a total distance of about 150 miles. The iron bearing range along the Aticokan was examined at a number of points, and although the trenches and test-pits, which had been made, were largely filled by caving in, enough was seen to show that there exist along the eastern half of the range, extensive deposits of remarkably rich and pure magnetite. Towards the western end of the range the ore bodies are banded in character, and the belts of clean ore are not extensive. Veins at Harold Lake, north of the Seine River, hold galena and pyrite, and show free gold in promising quantities. The very interesting rocks about Steep Rock Lake were examined, and the facts noted were found to be in accord with the views as to the age and stratigraphical relations of the series, expressed by the late W. H. C. Smith, in a paper read at the Ottawa Meeting of the Geological Society of America on the 30th December, 1892,* and by H. L. Smyth, in the American Journal of Science, 1891, vol. XLII., pp. 317-331. The series shows evidence of complicated folding at two different times and caused by forces acting from different directions. It includes heavy beds of limestone, beds of sandstone, slate, greenstone, etc., and seems to occupy a position above the

*Bulletin of the Geological Society of America, vol. IV., pp. 333-348.

great mass of the Huronian (Keewatin) rocks of the district. Mr. Lawson made surveys of lakes, etc., along the route which will add to our knowledge of the topography of the region.

August the 10th to September the 6th was occupied in a survey of a series of lakes lying between Konepiminanikok and Windigoostigwan lakes, west of the township of Kars. The whole route was found to lie in gneisses, an extension of those which occur at Pickerel Lake to the west. The route is a difficult one, with long portages, and the total distance traversed in going and returning was about 140 miles.

The last month of the season, or until October the 8th, was utilized to make a micrometer survey from Lac des Isles, by a series of lakes to the north branch of Dog River and down that river to where the old Red River route leaves it and strikes across towards Savanne River, a distance of about sixty miles. This route was found to be occupied everywhere by gneiss, though the presence of boulders of Nipigon rocks in large numbers along the upper stretches of the north branch, indicate that this series is probably in place at no great distance to the north. The north branch of Dog River was found to have its source in a small lake lying in N. latitude $49^{\circ} 15'$. The total distance travelled in the different traverses and surveys during the summer was in the vicinity of 600 miles. Ottawa was reached on the 18th of October, and office work taken up, attention being first given to the plotting and reduction of the surveys made during summer. When the work is finished it will afford all the data required to complete sheets Nos. 6 and 9 for the engraver.

The cost of the season's explorations was \$1,752.76.

After the close of the field operations on the 8th of October, 1892, Mr. A. E. Barlow, assisted by Mr. J. F. E. Johnston, was engaged in plotting the instrumental surveys which had been made, copying and reducing township and other plans and in making such rough compilations of the Crown Lands surveys and their own as were necessary for use in the field. The specimens collected had to be permanently labelled and studied in connection with mapping the geological and lithological boundaries. Besides these principal duties some time was taken up in preparing accounts of expenditure in connection with the field work and other matters of minor importance. Before leaving for the field last spring it was thought possible to complete sheet 131 of the Ontario series of geological maps, but a few weeks of next season's work will be required before this map is ready for publication. Mr. Barlow reports as follows:—

"During the whole of the past year I have been assisted by Mr. J. F. E. Johnston of this department, who has had charge of the topogra-

phical portion of the work. He left Ottawa on the 18th of May with instructions to make a survey of the roads in the vicinity of Mattawa, and after its completion to undertake a re-survey of Lake Keepawa. He was joined in the field by Messrs. A. M. Campbell, of Perth, and E. M. Burwash, of Victoria University, Toronto, both of whom by the zealous performance of their duties contributed much to the success of our exploration. The old survey of Lake Keepawa, made many years ago for timber limit purposes, was found very inaccurate in places, while in others the survey did not give sufficient detail.

"The re-survey of this crooked stretch of water necessitated a micrometer line of three hundred and thirty-five miles, which served as a base for further triangulation. This survey, when plotted, will represent very faithfully the tortuous shore-lines and numerous islands of this lake. Mr. Johnston completed this survey on the 26th of July, being delayed by violent wind and rain storms, especially in the earlier part of the season. As usual, a great portion of the time was occupied in making such surveys, as they were very necessary to enable me to delineate the geological details with sufficient accuracy, but the division of the work, Mr. Johnston devoting his whole time and attention to the topography, enabled me to work out the geological structure in greater detail.

"From the 18th of May to the 6th of June, in compliance with your instructions, I was in Chicago, engaged in studying the very instructive exhibits of rocks and minerals at the World's Columbian Exposition.

"Leaving Ottawa for the field on the 19th of June, I reached Sudbury the following day and was joined by Dr. Adams, of McGill University. Together we made a further examination of some of the many points of geological interest presented in this district. Mr. H. N. Topley, photographer to the department, accompanied the party and took some additional views of geological phenomena, besides colouring other views previously taken, to illustrate some of the contacts exposed in the vicinity of the Canadian Pacific Railway.

"Leaving for Mattawa on the 26th of June, a few days were spent examining the rocks of that neighbourhood. The greater part of July was occupied in a detailed examination of the rocks exposed on the shores of the Ottawa River and of Lake Temiscaming from the old Hudson Bay Company's post to Mattawa. During the same time Mr. Topley took some excellent large geological photographs. During August and September the country lying to the south of the Mattabetchouan River and Rabbit Lake was examined, and Mr. Johnston made careful micrometer surveys of all the available routes connecting with the base and township lines of the Ontario Crown Lands Depart-

ment as well as with surveys made by me during the previous summer. The streams in this district are very small, and with the exception of the Mattabetchouan River are only travelled by the Indians in winter or early spring, so that a great deal of time was consumed in chopping out the narrow portage roads necessary for carrying the supplies from lake to lake. The country is all densely wooded and is covered with a second growth of very excellent white and red pine, which although rather small, in many cases, for square timber would make excellent saw-logs. The line of the Nipissing and James' Bay Railway, as located last summer, runs north from North Bay passing to the east of Lake Tilden and Lake Marten and thence crosses Wicksteed Lake by a number of rocky islets. It then continues to the west of Boice, Red Water and Rabbit lakes and reaches Temagami Lake at the north-western extremity of the north-east arm. This is as far as the line has been located, and the engineers consider it an eminently feasible route. Most of the country traversed is comparatively flat, but drops suddenly in the vicinity of Lake Temiscaming and the Ottawa River which seems to occupy a very low depression. Lake Temiscaming, as its name implies, is very deep and the captains of the steamers plying on its waters assert that off the mouths of the Keepawa and Montreal rivers the lead only touched bottom at 1,800 feet. A sketch of the geology has already appeared in last year's summary and it is thought unnecessary to go into further detail pending the publication of the finished report. The main geological boundary on the sheet, the division between the Laurentian and Huronian, was examined in further detail and can now be mapped with great precision. A collection of fossils comprising about 500 specimens was made from an outlier of the Niagara formation exposed on the shores of Burnt Island (Mann Island), besides about twenty specimens from a small outlier of limestone (Trenton?) reposing on the gneiss on the north shore of the Ottawa River about five miles and a half below Mattawa. A boulder of diabase was found on the west side of Bear Island, Lake Temagami, containing porphyritically developed crystals of plagioclase. The crystals are very large and exhibit the twinning lamellæ with great beauty. They may represent the original condition of the altered form of plagioclase, Huronite, found *in situ* in many places near Missinaibi station on the Canadian Pacific Railway, in the vicinity of Lake Huron and elsewhere.

"Some fine specimens of microcline (amazon stone) and perthite were obtained from lot 7, concession B of the township of Cameron. These have been placed in the museum. A good suite of about 700 specimens was collected, representative of the Laurentian and Huronian rocks as exposed in this region. These have all been properly trimmed and

permanently labelled and samples of over a hundred of the more doubtful ones have been sent to Germany to be cut in thin slices for future study under the microscope.

"The measurements made were: by micrometer and compass 504 miles, pacing and compass fifty-three miles, total 557 miles. Finishing the survey we returned to Ottawa on the 12th of October.

"After the close of the season's field work, Mr. Johnston was occupied till the end of the year in plotting the various surveys made. During November, Mr. Barlow's time was taken up in classifying and arranging the numerous rock specimens collected. In December, it was deemed advisable that he should proceed to Montreal, and with the assistance of Dr. Adams, who has been at work for the Survey on areas of similar rocks in southern Ontario, study sections of the more doubtful specimens under the microscope."

The cost of the season's explorations was \$2,107.

Dr. Bell reports as follows on his work during the past year:—

"Between the beginning of the year and the commencement of field operations the time was spent in the office as usual, in going over the notes of the previous season's operations, plotting the surveys and explorations which had been made by myself and assistants, and in studying the geological results. A portion of the time was required for correspondence and supplying information asked for, in making preparations for the next season's field-work, etc. A report was partly prepared in reference to sheet 127, but as the geology of sheet 129, which was to be worked out during the summer, is a continuation of the former, it was decided to incorporate the descriptions of these two sheets in one report, as soon as the field work required for the latter should be completed.

"During the season for field operations, I again carried on the working out of the detailed regional geology in the country north of Lake Huron, in continuation of that of the last few years. I was assisted by Messrs. H. G. Skill, W. G. Miller, B.A., R. W. Brock, T. L. Walker, M.A., and W. A. Dent, this having been the fourth season for Mr. Skill, the third for Messrs. Miller and Brock, the second for Mr. Walker, and the first for Mr. Dent. In addition to these gentlemen, canoe men and a cook were employed from time to time as required.

"Our work was principally in sheet 129, which lies within the same latitude as the Sudbury sheet and abuts on it to the west. Sheet 129 may be called, for convenience, the North Shore sheet. But in addition to this we completed the geology of the narrow strip along the lake front with its adjacent islands forming the northern part of the

Manitoulin sheet, No. 126. As the French River sheet, 125, was completed last year, we can now show the geology throughout a solid rectangle consisting of this and the three following sheets: Manitoulin, 126, North Shore, 129 and Sudbury, 130, while the work done in sheet 128, in former years, enables us to carry the geological lines with tolerable accuracy as far as the east end of Lake Superior. Some further geological and geographical details will, however, require to be ascertained in the north-eastern portion of sheet 128, before it will be ready to publish with as much completeness as the sheets between it and the Ottawa River.

"Sheet 129 proved a rather difficult one to work out, owing to the want of good canoe routes and of roads except a few very rough ones used by lumbermen for "toting" supplies to the shanties. As a rule the ground is very much broken and encumbered with boulders and the woods thick and tangled, consisting of a dense growth of coniferous underbrush with larger trees growing up through it. Still by perseverance we managed to work out the geology of the district so as to represent it fairly accurately upon sheet 129. In regard to topographical details, we were much aided by the township maps which have been made by the various lumbering concerns for their own purposes. While the outlines of these townships have been laid down by the Crown Lands Department and posts planted at every six miles to mark their corners, a considerable number of them have been subdivided into sections and quarter sections and the topography sketched in by employees of the lumbering companies. The heads of these firms or their agents kindly allowed us to make tracings of any of their maps, and for assistance of this kind our thanks are due to all the lumbering firms in the district gone over.

"I left Ottawa for the field on the 3rd of July, and on the 5th was joined by all my assistants at Spanish River, which we made our post office address for the season. We devoted ourselves first to working at the geology of the shores and islands to the east and west of Spanish River, and on the 18th of July we left this place in two large wooden canoes for an exploration inland by way of Blind River, the mouth of which was reached the following day. From Mountain Lake on this stream we proceeded through Magog Lake and thence explored the country northward. Returning to the south end of Mountain Lake, we ascended Blind River to Chiblow Lake and the two divisions of Tendenenda Lake, all of which had been surveyed topographically by the late Mr. Alexander Murray, of the Geological Survey, in 1863. Besides revising the geology of the shores of these lakes we made explorations inland from them in various directions. After completing this work we arrived back at Spanish River on the 31st of July.

Messrs. Walker and Dent were next sent for a few days to make detailed examinations and to collect specimens of the rocks about the mouth of Spanish River and thence westward towards Cook's Mills, Mr. Skill to make a sectional traverse of the peninsula between Lake Huron and Spanish River across McBean Mountain, while Messrs. Miller and Brock accompanied me to some of the islands east of Spanish River.

"My personal share in the field-work was now interrupted for a short time in order to undertake a journey, with your approval, to the United States for purposes which I shall explain. There had been disagreements or rather misunderstandings between the Canadian and United States geologists, as well as among the latter themselves, as to the interpretation of many facts concerning the Cambrian and Archaean rocks which are common to both countries in the Lake Huron and Lake Superior region. In order to try to harmonize the work on both sides of the international boundary and to come to an understanding more satisfactorily and effectually than would be possible by the mere written accounts of geologists working altogether independently of one another, it was agreed that a party of those interested in geological investigations in the regions in question should proceed together and inspect certain typical occurrences of these rocks in northern Michigan. With your consent I left Spanish River on the 7th of August and joined this party at Ishpeming on the 9th. After looking at the Huronian rocks at this locality, the party went to Houghton and the Calumet and Hecla mines and viewed the Keweenaw or Nipigon formation of that region. From Houghton we proceeded to the Gogebic district and inspected the iron-bearing rocks around Bessemer and Ironwood. These examinations were important as they enable me the better to compare the views and conclusions of the United States geologists with our own.

"With reference to this subject, I may here make a few very brief observations. In addition to the present occasion, I had visited the Ishpeming region in 1860 in company with the late Mr. Alexander Murray, of the Geological Survey of Canada, when the great iron mines were being first opened, and again alone a few years ago. The iron-bearing rocks of this locality appeared to me, as they did to Mr. Murray, to belong to the ordinary varieties of the Huronian series of Lake Superior, and they may be compared with that phase of the System which is developed in the valley of the Mattawa or west branch of the Kaministiquia River.

"The rocks which run through the north-western half of Keewawona (now called Keweenaw) Point, and in which the deposits of native copper occur in the vicinity of Houghton, are believed by all

geologists to be the equivalents of our Nipigon series,* in which native copper also occurs on Michipicoten and St. Ignace Islands and Isle Royal. By the United States geologists they have been called by a variety of names, all derived more or less directly from the original name of this point, which is the Ojibwé word for northward. These rocks consist of red and gray sandstones, conglomerates, marls, shales, etc., interstratified with a variety of igneous rocks, especially amygdaloids, tufas and greenstones, all dipping at moderate angles to the north-westward. The southeastern part of Keewaiwona Point consists of red and gray sandstones newer than the copper-bearing series.

"The rocks which we saw in the vicinity of Ironwood consist of a series of silicious schists, quartzites and a flaggy silicious rock containing a considerable percentage of iron carbonate, all dipping at a high angle to the northward and resting upon a gray granite. They were cut at various angles to the horizon by dykes of diorite which are now more or less altered into a soft variety of serpentine. As pointed out by Professor Van Hise, the accumulations or masses of hematite of this locality, which are mostly soft, are formed from the percolation of iron in solution, derived from the iron carbonate, which deposits the oxide upon any nearly impervious floor or receptacle formed either by the inclined dykes or by folds in the underlying rocks. These iron-bearing rocks appear to me to be equivalent to a part of the Animikie series. Their resemblance to the rocks of the Manitounuck group of this series on the East-main coast of Hudson Bay is closer than to those of Thunder Bay, although it appears to be sufficient to identify them with the latter also. In the former region, light gray quartzites, like those of Ironwood, are to be found and a thinly bedded manganiferous carbonate of iron of great purity is largely developed. This series, like the Animikie of Thunder Bay, is clearly unconformable to the Huronian. The two sets of rocks are not only separated in both regions by the most marked unconformity, but the Animikie strata in both instances are unaltered, and have evidence of organic existence, while the Huronian are, as a rule, thoroughly crystalline and belong to the Archæan. In connection with this controverted point in the geology of Lakes Huron and Superior, it is important here to note that last summer we found thinly bedded chert-rocks in every way like those of the Animikie formation of Lake Superior, in an unconformable attitude to the nearest outcrop of Huronian, at about thirty-five miles north of Algoma station on the Canadian Pacific Railway. These thinly bedded cherts, limestones and the light coloured quartzites, forming a small area between Thessalon River

* This series is the upper division of Logan's Upper Copper-bearing rocks, *Geology of Canada*, 1863, pp. 77-84.

and Lake George, may also belong to this series. They appear to me to rest unconformably upon the rocks of the great Huronian area which surrounds them, and the occurrence of this comparatively small inlier may have given rise to all the confusion in regard to the meaning of the terms Huronian and Animikie, and to the false impression that the Huronian rocks north of Lake Huron dip at low angles, whereas they are almost everywhere nearly vertical. The existence of a little patch of Animikie upon the Huronian of this region, would, by no means, justify the attempt to abolish altogether Logan's well founded name Huronian.

"On the breaking up of the above geological party, and with the approval of the Minister of the Interior and yourself, I paid a short visit to the World's Columbian Exhibition at Chicago, stopping on the way for a few days at Madison, Wisconsin, where the American Association for the Advancement of Science and the Geological Society of America were holding their meetings. Chicago was reached on the 21st of August, and on the 3rd of September I started back by steamer to continue my geological work, and reached Spanish River on the 6th.

"Before leaving on the above journey, I had given detailed instructions to my assistants and provided them with complete outfits for carrying on the field-work in two sections during my absence, and it was gratifying to find that they had done so successfully and returned to Spanish River two or three days in advance of myself.

"Messrs. Miller and Brock made excursions northward from Webbwood, Cook's Mills and Thessalon, the last extending into the township of Morin; while Mr. Skill made a track-survey of Serpent River, and the lakes upon its course, simultaneously with his geological examinations. From one of the lakes near the source of Serpent River he followed a chain of lakes hitherto unexplored, southward to Tendenda Lake and thence returned to Lake Huron by the Blind River. Messrs. Walker and Dent were sent to explore the region in the neighbourhood of the Sable River. They followed the roads which have been cut by the lumbermen through the thick woods of that region, and reached the northern part of township 124 on the main Sable and the north-western part of township 130 on one of its western branches.

"Mr. Dent started for home on the 11th of September, in order to resume his duties at the University of Toronto; Mr. Walker left on the 19th of the same month, and Mr. Miller went to Kingston on the 24th, in order to take a lectureship in the school of mining, which was just about opening in connection with Queen's University. From the 14th of September to the 13th of November, Mr. Skill made three

trips by canoe and on foot for the purpose of tracing out the subdivisions of the rocks in the central and northern parts of the sheet, at the same time making good track-surveys of the lakes and streams he passed through, and fixing as many points as possible with reference to the posts and lines of the Government land surveyors. He left for home on the 16th of November.

"In township 164, about thirty-five miles north of Algoma, he found thinly bedded black and olive and yellowish-green chert rocks lying almost horizontally, while the nearest outcropping Huronian strata dip at high angles. These rocks appear to be unconformable to the Huronian, and it is probable they may be contemporaneous with the similar beds of the Animikie formation of Thunder Bay.

"From the end of October till the 18th of November, assisted by Mr. Brock, I worked in the eastern part of the sheet, most of the time having been spent in the townships around Massey, where a considerable variety of rocks occur, the boundaries of each of which required to be traced out. Sunday and Monday, the 19th and 20th of November, were spent at Sudbury, where I obtained some information as to the progress of mining in that district, and I reached Ottawa on the morning of the 21st.

"The following is a very brief summary of the leading geological results of the season's operations. Except in the south-west corner, which was worked out by the late Mr. Alexander Murray, the distribution and general character of the rocks within the limits of the North Shore sheet turned out to be quite different from what had been supposed. The central part of the sheet is occupied by the stratified members of the Huronian system, together with some massive greenstones, and this central area is surrounded on all sides by granite, with the exception of a gap towards the west, and a narrower one to the south near the south-west corner. The granite also occurs in the form of a rather narrow belt twenty-eight miles in length from east to west in the centre of the sheet. This granite is like that of the Sudbury sheet, of which it is a continuation. It is nearly always red, of medium texture, and consists of about equal parts of orthoclase and quartz, with a small proportion of hornblende and a little mica. It is still uncertain whether this great area of granite should be classified with the Laurentian or with the Huronian.

"The stratified Huronian rocks appear to extend nearly to the north border of the sheet or twice as far inland as had heretofore been supposed. In the north-east corner of the sheet they reach township 115 or the one next west of Craig and are a continuation of the Straight Lake inlier, which is shown on the Sudbury sheet. In the southern part of the sheet a tongue of the granite, twelve miles wide, extends

from the main body in the neighbourhood of the south-west bend of Spanish River due west to the townships of Long and McGiverin.

"On the south side of this tongue an arm is given off in the township of Victoria which extends due west or parallel to the main body as far as Serpent Point. It is separated from the main tongue by a rather narrow belt of schists, principally micaceous. Much of the granite within the sheet is remarkable for the large quantities of greenstones which are mixed with it. This is also a feature which characterizes the area of gneiss lying between Sault Ste. Marie and Goulais Bay. The extension to the south-eastward of the greenstone area of Tendenenda Lake has been already referred to as well as the existence of several large areas of this rock among the stratified members of the Huronian series about the south-east corner of the sheet. A belt of greenstone extends from this vicinity westward with some interruptions as far as Black Reef in the North Channel of Lake Huron, a distance of about fifty-five miles. Another interesting point was the discovery within the sheet of rocks like those of the Animikie formation already referred to. Besides the above main features, a vast number of new facts as to details were of course noted. The number of photographs was purposely limited to views of geological interest and a few of characteristic scenery, only about twenty in all having been taken.

"Cost of season's field operations extending over nearly five months and including salaries of all assistants, \$2,480. Cost of journey with United States geologists and visit to World's Columbian Exhibition, \$150."

During 1892, and early in 1893, considerable attention had been attracted to certain mineral discoveries in the townships of Dalton, Digby, Lutterworth, Somerville and Ganway, in Ontario, and as up to the present time not even a preliminary examination of the Archæan rocks had been made by the survey in this part of Ontario, north, east or west of the above townships, it was considered desirable to make some investigations in that district during 1893. Dr. Adams, of McGill College, was requested to undertake this work. He left Montreal on the 17th of June and returned on the 10th of September. His preliminary report is now being printed as Part J, vol. VI. of the Annual Report, 1891-93. Mr. Adams likewise made a preliminary examination with a view to future detailed mapping of the area included in sheet No. 118. It is hoped this will be proceeded with next summer.

Dr. Ells's attention during the past year has been devoted to the work required for the completion of the geological map, sheet No. 121 of the Quebec series, on the scale of four miles to one inch. The eastern limit of this sheet is the western limit of the south-west sheet of the Eastern Townships map, now ready for the engraver and publication, and its western margin is a few miles west of Ottawa city. It covers an area of nearly 4,000 square miles, the south-east corner of which is a part of the province of Ontario.

The winter was devoted by Dr. Ells to the compilation of the many separate and disconnected surveys that had been made by this department and by the Quebec Crown Lands Department, which were required to complete the sheet referred to. Dr. Ells commenced field work early in May, and reports on the season's operations as follows:—

"The surveys and investigations required for sheet No. 121 were for the most part within the counties of Ottawa and Pontiac in the townships bordering the Gatineau River. The examinations were extended northward to the River Desert, about ninety miles from its junction with the Ottawa, and surveys were made of all roads in these townships as well as of those in portions of Lochaber, Buckingham, Templeton, Mulgrave and Ripon.

"Most of the lakes and streams at all accessible for canoes have been explored, and their geological and mineralogical features carefully examined. Further detailed observations in the more immediate vicinity of Ottawa are yet necessary before the somewhat complicated geology of this section can be fully mapped. This can be completed next summer.

"During the season I was assisted by Messrs. W. A. Merkley, an undergraduate of Toronto University, and Christopher Forester, a graduate of the School of Practical Science in that city. Of both these gentlemen I may say they did the work entrusted to them in a satisfactory manner.

"An examination of some of the lakes on the upper waters of the Blanche River in Derry township, was made early in May, but the season being late, the final start for the field was not made until the 29th of that month, when camp was pitched near Wilson's Corners on the line between Hull and Wakefield. From this point a careful examination was made of all the known openings for mica and phosphate in the townships east of the Gatineau, with the view of obtaining and recording all the facts bearing on the mode of occurrence and the geological relations of these minerals, and whether they occupy any

definite horizon in the Laurentian rocks.* This work was subsequently extended to the western side of the Gatineau River, the outcrops of the limestone bands were determined, with their relations to the associated gneisses and quartzites. Several excellent photographs were taken of the mica mines, showing the occurrence of the mica in the pyroxene near the contact with the gneiss; also of the great pyroxene-diorite dyke, near the Little Rapids mica mine. This dyke cuts almost directly across the strike of the red orthoclase gneiss. Photographs of the limestone conglomerates† in rear of Calumet station on the Canadian Pacific Railway, were also taken later in the season.

"A careful exploration of the several chains of lakes on the Upper Blanche, in Mulgrave, Ripon, Lathbury and Villeneuve townships was made in July, in canoes, and several outcrops of limestone were traced through this area, one of which, on the east side of lakes Gull and Hawke, is slightly serpentinous and has been quarried in the search for chrysotile. A more important serpentinous band occurs, however, in the north-east angle of Big Blanche Lake, and openings have been made on it by a Montreal company. Small veins of chrysotile were found, but the fibre, as is generally the case in these rocks, was too short to be of much economic importance, and the quantity is not sufficient to repay the cost of its extraction. These chrysotile deposits are found at many points, in fact wherever the limestone has been serpentinized, the quantity, of course, varying at different localities; but in none yet examined does there appear to be sufficient to warrant the investment of capital for its extraction.

"After finishing the examination of the Blanche Lakes, a portage was made to the Lièvre River; and thence by a chain of lakes through

*A very excellent and exhaustive report on this question, with illustrations, was made by Dr. Bernard J. Harrington in 1877 (see part G, Geological Survey Report, 1877-78), and it may be doubted whether further investigation will result in any better explanation of the facts, as affecting the occurrence and the mining of these deposits, than is given by Dr. Harrington in the report referred to.

The facts in relation to these deposits have again been recently studied in detail by Mr. Ingall over an area of some 150 square miles within the townships of east and west Portland, and in a large part of those of Buckingham and Templeton, including small portions of the contiguous townships. This examination includes all the chief working and worked mines of apatite in Ottawa county besides some opened on deposits of asbestos (chrysotile), mica and plumbago, comprising some eighteen to twenty mines in all.

This work has been reported upon by Mr. Ingall in the Summary reports of this Department for 1889 and 1891, and in the report of the Division of Mineral Statistics and Mines for 1890 (part S, pp. 155-157, vol. V., 1889-91).—A. R. C. SELWYN.

†Having examined specimens collected by Dr. Ells of the supposed pebbles from these "limestone conglomerates," I wish to state that I cannot regard these included gneiss fragments as pebbles in the ordinary acceptance of that term, or that there is any conclusive evidence that the rocks of this series, gneisses, quartzites and limestones, are the result of aqueous abrasion and sedimentation. Some other cause must, I think, be sought to explain the parallelism of the structural layers and their alternating lithological characters. In any case much more detailed and careful investigation is yet required before any decided opinion can be safely expressed on the very obscure and interesting question of the real cause of the parallel structural layers in the Archæan gneisses.—A. R. C. SELWYN.

the Big and Little Whitefish lakes and the creek connecting the latter with the Gatineau, which was reached in the township of Héncks, and thence descended to the Pagan Falls. The portion of the river above the falls is very rough. Side excursions were made to the Plomb Lakes and to the St. Germain chain in Denholm and northern Wakefield. Mica occurs in several places, among which may be mentioned lot 13, range II., Denholm. The deposit has not been developed, but the specimens from the surface are clear and of good colour. At the foot of the Pagan Falls a considerable area of serpentinous limestone occurs, presenting the same concretionary like structure noticed at the Templeton mine, near Perkin's mill. Veins of fine silky chrysotile occur here, and a number of openings have been made at various points, both on the bank of the Gatineau and in the hills a quarter to half a mile to the east. This chrysotile is for the most part in veins of short fibre a sixteenth to half an inch in length, generally under the half inch, and their distribution is usually around cores and concretionary masses of whitish pyroxenite with which the serpentine zones occur. The deposit at this locality and that of Templeton are among the most important yet observed, but the shortness of the fibre generally, and its small percentage as compared with the quantity of rock necessary to be removed for its extraction, renders its successful mining very doubtful. From the Pagan eastward to the township of Portland the rocks are for the most part gneissic; one small band of limestone was seen on the St. Germain Lake, at the south end, the rocks on the other lakes of this chain being gneiss and quartzite. Near the end of the road east from the Pagan Falls, about four miles from the river, a deposit of mica has been recently opened at Wilson's which has yielded some good crystals, and several tons of mica have been extracted.

"From the Pagan Falls we went to the confluence of the Pickanock River, a branch of the Gatineau, sixty miles from its mouth. This stream was ascended to Otter Lake in the township of Leslie, from the head of which a portage road led to Lake Dumont, at the head of the Pickanock. The rocks about the upper portion of this branch and around the lakes where exposed, are mostly reddish and gray gneiss. A thin band of limestone was crossed on the portage road to Lake Dumont, but could not be traced owing to drift. At the east end of this lake, which is north of the township of Clapham and is the largest body of water in this direction, a band of gneiss, mixed with pyroxene, occurs, but no trace of mica or phosphate could be found. Reported outcrops of mica and phosphate at several points were examined, but the quantity seen in every case was insignificant. West of Otter Lake several bands of pyroxene were seen, but these

also appeared to be barren of useful minerals. Returning from Lake Dumont and Otter Lake, the shores of Lakes Landikegama and Kontuagama were examined, but these present no ledges owing to the extensive mantle of sand and gravel which is spread over this area. At the north end of Kontuagama, a band of limestone occurs in the hills to the north, overlying grayish and quartzose gneiss. The limestone is cut by pyroxene dykes carrying a few small mica crystals (phlogopite), but nothing of economic importance was noted. Some dykes of dark hornblende rock at this place have been regarded by the settlers as probably iron ore, but none was observed by us in this vicinity.

"From the north end of Kontuagama Lake a road extends for about fifteen miles to Wright P.O., near the mouth of the Pickanock. This road traverses a gneiss area for eight to ten miles without limestone outcrops, beyond which the calcareous portion of the formation begins and increases in extent as the Gatineau is approached.

"From Wright P.O., an exploration of the lakes lying between this and the Desert River was made. This included the Sturgeon, the Blue Sea, and a chain lying to the east, and the Big and Little Cedar lakes, from the latter of which a canoe route extends by the Bittobee Creek and Lake to the Desert which it meets about a mile west of its junction with the Gatineau, ninety miles from the Ottawa. The prevailing rock in this direction is crystalline limestone with occasional ridges, for the most part showing an anticlinal structure, of reddish and gray gneiss. Large areas are drift covered, and in the river valleys, as well as in much of the country underlaid by the calcareous rocks, soils of good quality occur. A large part of the township of Maniwaki, now an Indian reserve, at the mouth of the Desert and on the south side of the river, is excellently suited for agricultural purposes. The lakes, which will be accessible by the Gatineau Valley railway, abound in trout, pike and bass.

"But few indications of economic minerals were observed. Mica was found near the road along the west side of the Gatineau on lot 36, range I., Bouchette, where several openings have been made in a pyroxene dyke which cuts red and gray gneiss and on lots 14 and 15, range D of Wright, a mass of mica crystals occurs in a dyke of pyroxene with calcite. The quantity of mica crystals is here very great and some of them are of large size and good colour, but are injured by having, in the centre in many cases, small inclusions of calcite. Similar deposits are found on the west side of Bittobee Lake, south of the Gatineau, near the line between Wright and Northfield, though the quantity of crystals is here much less and they are of smaller size.

"In the township of Aylwin another deposit of mica (muscovite) occurs, about half a mile north of Venosta station. It occurs here in a dyke or vein of felspar and quartz, cutting grayish garnetiferous gneiss and some very excellent crystals were at one time obtained. The mica, however, appeared to terminate in the place where worked, which was near the centre of the dyke, and the mine was in consequence abandoned. It is possible that following the usual mode of occurrence of this mineral in dykes or veins, it would be better to look for it near the contact with the gneiss.

"In the township of Hincks, on lot 22, range II., on land owned by J. Quinn, of Aylwin, mica (phlogopite) occurs in large smooth crystals in a pyroxene dyke cut by a cross dyke of felspar. The mica is dark amber coloured, but the size of the crystals and the freedom from inclusions and flaws enables plates of extra size to be easily obtained.

"The character of the country north of the township of Low differs very greatly from that nearer the Ottawa River. In the vicinity of Kazubazua, and for some miles to the west, great areas of level drift covered land occur, known as the Kazubazua plains, and this character of country extends northward to the Pickanock River. Occasional ridges of reddish and gray gneiss are seen, but much of this district along the Gatineau Valley railway is well adapted for settlement.

"The month of September was devoted to mapping the sedimentary Cambro-Silurian formations, which occupy the level country along the south side of the Ottawa, and to the examination of the mica and graphite deposits of Grenville, Lochaber and other areas in that direction.

"The surveys of the season have enabled us to outline over large areas north of the Ottawa many of the limestone belts which apparently form the upper member of the Laurentian system as we now interpret the structure. Throughout the townships east of the Lièvre, these calcareous rocks generally occur in narrow but well defined bands, the synclinal structure of which is shown as in the areas on the Rouge and Nation rivers. The limestone bands diminish in extent when traced northward towards the height of land, the underlying red and gray gneiss being there the prevailing rock, the strongly marked hill features become less pronounced, and there is, over great areas, a broad mantle of stratified sand and gravel overlying blue gray clay. On the Gatineau, however, after crossing the generally rugged area which extends upwards for twenty to thirty miles, there is a great development of the calcareous formation. On the east of that river it occupies a large part of the country between the river and the Thirty-one Mile Lake, and on the west side it is well developed for several miles along the

lower Pickanock River. It also occupies the greatest part of the country north, to and beyond the Desert River, and is well exposed about the Blue Sea and Cedar lakes.

"The principal minerals found in the area under discussion are apatite, mica, graphite, asbestos and iron ore.

"The present depressed condition of the phosphate market has had the effect of almost entirely closing the mines of this mineral for the time being. Only two are at present operated, viz., the High Rock-mine and the Etna mine, both on the Lièvre River. At the former, about thirty to thirty-five men only have been employed during the season. At the latter, a successful application of the diamond drill has been made by Mr. Smith, the manager, to find further deposits of apatite; the drilling was extended horizontally from the bottom of the present shaft, which is about 135 feet from the surface. The drill worked easily in the pyroxene rock, and several large deposits of apatite were found which are now being mined.

"The graphite deposits of Buckingham have not been worked during the past year. At the Walker mine and at Donaldson's Lake they are very extensive and the percentage of graphite high.

"A deposit of columnar graphite of high grade, in a felspathic rock on the south-east corner of Lake Terror has been worked by Messrs. Lewis, of Montreal. Some prospecting has also been done in the township, and the result has shown the existence of some very promising deposits which will doubtless be developed. There are other deposits of graphite in Lochaber, some of which were worked years ago,* but latterly these have been neglected, though the quality appears to be very good.

"New and important discoveries of mica are still being made, the latest being in the township of Hincks already referred to.

"At present mica is the economic mineral of greatest importance in the district; a careful examination of as many as possible of the openings was made with a view to determine its geological relations, its mode of occurrence, and where it may be usefully sought for in unexplored districts.

"Many of the phlogopite and biotite mica deposits, like nearly all those of apatite, occur in association with pyroxene rocks; but unlike the apatite, muscovite or potash mica of commercial value is found in veins or dykes of pegmatite.

"It appears that the occurrence of mica in workable quantity and size may be classed under five heads, as follows:—

"1. Deposits in which the crystals occur in pyroxene rocks near the contact with the red or gray gneiss. In these considerable quan-

*Geology of Canada, 1863, p. 794.

tities of apatite are also often found. In many places the matrix of the mica and apatite is a pink calcite, which forms irregular pockety masses or veins.

"2. Deposits in massive pyroxene, where the mica occurs in irregular bunches apparently along fissures in the pyroxene, as at the Cascade mine.

"3. Deposits in pegmatite veins cutting gneiss, as at the Villeneuve mine, where no apatite occurs, or if at all, merely in small scattered crystals.

"4. Deposits in pyroxene in association with cross dykes of felspar, as in the Quinn mine in Hincks. Apatite occurs in a similar manner at the Etna mine on the Lièvre, where a thick diorite dyke cuts the pyroxene.

"5. Pyroxene and pegmatite veins cutting crystalline limestone in which crystals of mica, for the most part of small size, and seldom workable, are found along the contact, the mica being in these cases generally of a dark bronze colour.

"In regard to the mica, it may be asserted that the 'white' or muscovite mica is always found (or at least in so far as we can ascertain) in pegmatite veins, as at Villeneuve, Venosta and at the new McGee mine at Escoumain, below the Saguenay. In the pyroxene deposits the mica is always of the 'amber' variety, phlogopite or magnesia mica, the lighter coloured occurring in association with the pale greenish-gray pyroxenes, while when the pyroxene is hard and dark, the mica assumes a correspondingly darker tint and a more brittle character.

"During the past season the occurrence of some very large mica crystals has been noted, one of eight feet in diameter being reported from the Cascades mine, while in the Quinn mine, numbers of crystals of three feet in diameter have been found. These last are comparatively smooth and yield plates of large size and good quality.

"The field work extended from the 10th of May to the 27th of October, and in this is included some time spent at Chicago, from the 2nd to the 19th of October, studying the geological and mineral exhibits."

Cost of the season's work was \$1,221.54.

Mr. Giroux was requested to complete the geological exploration of that part of the north-west quarter sheet of the Eastern Township map to the west of the St. Maurice River, and on this work he reports as follows:—

"I left Ottawa on the 2nd of June, and proceeded to Joliette, whence I went to Quebec to get copies of certain plans of new surveys,

and on the 17th reached St. Michel des Saints, on the Mattawin River, in the township of Brassard. On the 20th I started down the Mattawin River with a party consisting of four men and two canoes; we pitched camp near the mouth of Rivière de la Bouteille, and from thence went to a small lake on Creek Lacroix which empties into the Mattawin at the head of Rapide Lacroix. On the east shore of this lake which is to the north of the Mattawin River, and 225 feet above it, there are outcrops of impure crystalline limestone, with much broken, rusty weathering whitish quartz in which are small pieces of magnetite. About half a mile further north and on the same side of the above lake is another crystalline limestone. It dips S. 60 W. < 16 , and rests on gray garnetiferous gneiss, and a short distance further north a bed nine feet thick of white crystalline limestone rests apparently conformably on quartzose gneiss which dips S. 25 E. < 25 a short distance north of this limestone outcrop. North-east of this place, and as far as the Mattawin River, a distance of about four miles, the rocks consist of highly quartzose grayish gneiss.

"From Rapide Lacroix to Rivière à la Chienne, down the Mattawin, the gneisses are much twisted and associated with granitic rocks holding in places thin veins of pink calcite.

"On the 30th of June, we started up the Rivière à la Chienne. It is very crooked and affords no ledges for about three miles, that is to the head of Lac de la Cache. One mile further up stream are falls ninety feet high over reddish gneiss full of small grains of clear quartz and dipping N. 80 E. < 14 . This gneiss varies greatly in composition and texture, being at times coarse and holding hornblende in large quantity, the bedding disappearing as the hornblende increases. From Lac de la Cache we portaged to a small lake on the west, 238 feet higher than the former, and about three quarters of a mile from it. The grayish gneiss around this lake is much twisted and contains black micaceous patches, and is cut by small veins of coarse crystalline felspar as seen in many places throughout this district. The gray hornblendic gneiss at the Falls of Rivière à la Chienne is met with on the next lake at a short distance from the last. The rocks there being much twisted the dip could not be accurately determined. About half a mile further, in a north-east direction, there is a small lake which empties into the main east branch of Rivière à la Chienne. On its north-east shore is a cliff eighty to 100 feet high composed of grayish and pinkish gneisses dipping N. 45 E. < 30 to 35. A characteristic feature of this section of the country is that the mountains are not as regular and rounded as they are to the south of the Mattawin River, but are cut almost perpendicularly in the small valleys and on the shores of lakes, forming cliffs 200 to 300 feet high.

The lakes are also deeper and their water very clear and with a greenish hue in most of them. Up to the head of Lac à la Chienne, or about twelve miles north of the Mattawin River the rocks consist of reddish gneiss, coarse and whitish weathering with a dip of N. 10 E. < 8 to 10 on the east side of the island, at the foot of the above mentioned lake. The inlet of Lac à la Chienne for about eight miles is very crooked and runs in a north-easterly direction through a low, flat country; but at that distance from the lake it takes a sudden turn to the north, and expands into a small lake at the south-west end of which is a cliff about 150 feet high, composed of heavy hornblendic gneiss, with quartzose and felspathic bands, which dips S. 40 W. < 40. From this small lake we went southward to Lac des Aigles and down its outlet for about three miles, where the gneiss is mostly reddish in colour, but holds here and there thin hornblendic bands. Having ascended Rivière à la Chienne six miles further, we portaged across to Lac au Sleigh, on the Pabelagnang River, where we experienced a terrible storm, during which a large poplar tree was broken and fell on our canoes which had been carefully placed at the end of the portage. Our bark canoe was broken, and two days had to be spent in repairing it. Lac au Sleigh is narrow and very irregularly shaped; it is about six miles long and surrounded by low hills of brownish gneiss weathering reddish and light gray. The bedding of this rock is generally very obscure, but where discernible it shows a dip of S. 60 W. < 25 to 30. The only large exposure seen around this lake is at the south end, where the bedding is very distinct; the rocks there consist of a brownish gneiss containing more quartz than elsewhere in this locality. Similar gneiss occurs around Lac Dorval, which is situated at a short distance north-east of Lac au Sleigh and between it and Lac à Baude are ledges of hornblendic gneiss. At the northern end of this lake is a mass of quartz and felspar rock with crystals of mica; the gneiss covering this mass is hornblendic and holds at its base layers of reddish quartz and felspar rock like that of the underlying mass. It also contains crystals of hornblende and garnet; it dips S. 80 E. < 35. At the western end of the above mentioned mass is a vein five feet wide of quartz and felspar rock, holding large crystals of biotite, and at the contact of this vein with the gneiss the quartz is almost black.

"Four miles further in a north-east direction is Lac Wakaumekonke. It is about eight miles in circumference and is surrounded by low hills. At its north end there is a cliff of much broken and jointed red gneiss, which is well displayed for a distance of about two miles and a half. It is followed by a very massive hornblendic rock, which shows neither bedding nor foliation. Following a chain of small lakes and portages in a north-eastern course for about three miles, we come to the Wes-

sonneau River at the dam between Lac Soucy and Lake Steam Boat Rock. The rocks on that distance consist generally of red and brown gneiss, intermixed in places with black hornblendic gneiss. We then went down this last lake about two miles and portaged two miles and a half to a small lake on Rivière à la Pluie, which we followed to its confluence with the Wessonneau River, fifteen miles from Lake Steam Boat Rock. We then descended the Wessonneau River, which is very rough and rapid, twenty-two miles to its mouth on the St. Maurice River. All along these last thirty-seven miles there are ledges of reddish and brownish gneiss, holding blackish micaceous bands. The formation is very much twisted and folded, and the dip varies greatly, being at times S. 60 E. < 28, then N. 60 W. < 12 and again S. < 18 to 20.

"Our provisions were now exhausted, so we descended the St. Maurice River as far as La Grande Anse, twelve miles north of the mouth of the Mattawin River. Two men were left there, and with two I proceeded to Grandes Piles and Joliette, where the necessary provisions were obtained. We started up the St. Maurice as soon as these were received at Grandes Piles for La Grande Anse, and on the 22nd of July left there for the Wessonneau River by a nine-mile portage road; along this road small ledges of grayish, brownish gray and blackish gneisses crop out here and there. The timber consists principally of hardwood, such as beech, birch, hard and soft maple, with fir, spruce, tamarack and cedar in the small valleys. We ascended Wessonneau River to almost the head of Lac Wessonneau where we made a four mile portage to Lake Steam Boat Rock. On an island situated near the middle of Lac Wessonneau are ledges of a dark brown micaceous gneiss exhibiting a dip of S. 50 E. < 15. Along the above portage road is a small lake, at the upper end of which are ledges of brown gneiss forming a cliff about 125 feet high. This gneiss is much broken and jointed, reddish-brown on weathered surfaces and partly covered with iron rust. At the outlet of Lake Steam Boat Rock, the gneiss dips N. 75 E. < 25, and can be seen here and there all along to the head of the lake, whence we proceeded in a general south-western direction to a lake about three miles long at the head of Rivière Gros Castor Noir, where I left two men and proceeded down this stream to its mouth on the Mattawin River, which we ascended for about three miles and one-half, and returned to the above lake by a different route, having thus examined the principal lakes of both branches of Rivière Gros Castor Noir. The rocks are much twisted all along these lakes: they consist principally of reddish-brown and brown gneiss, forming high, bare mountains. From Gros Castor Noir lakes we travelled westward by a chain of lakes and portage roads to

the waters of Rivière Pins Rouges, which we descended to its mouth and along which the gneiss is highly felspathic and quartzose and exhibits an occasional low dip to N. 40 W. From the mouth of Rivière Pins Rouges we ascended the Mattawin River to the foot of Rapide des Aigles and from there started through the woods with two men to go to Rivière des Aigles with the intention of ascending it as far as the small lake which we reached before from the sharp bend of Rivière à la Chienne. But unfortunately my guide cut his knee badly with an axe whilst making his way through a very bad swamp near the first lake on Rivière des Aigles, and this necessitated a change in our plans as the poor fellow could not move for several days. As soon as he could walk a little we marched back to Mattawin River, which we descended to the mouth of Rivière des Ours, where the other two men were awaiting us. Near the lake where the above accident happened, the reddish gneiss becomes much more quartzose and holds large veins and numerous patches of almost pure quartz mixed with very little pinkish or reddish felspar. This gneiss dips S. 40 to 45 W., and as far as I could see extends northward to the limit of our exploration and undoubtedly much further. As far as observed it contains less iron and mica than the gneisses to the south of the Mattawin River, although small quantities of magnetite are disseminated through it in many places.

"We ascended la Rivière des Ours by a series of portages and lakes to its upper waters, whence we crossed to Lac des Iles on the Shawenegan River. In all this distance, about fifteen miles, the rocks consist of gneisses varying very much in the relative proportions of quartz, hornblende, felspar and mica in their composition. At times they are highly quartzose and at others micaceous and hornblendic. In places they are much jointed and twisted and are cut in all directions by veins of felspar and bluish quartz. In a few places their dip is very distinct at an angle of about 20° to the south-westward. At the outlet of Lac Pinz Gonke we took a fresh supply of provisions, and went to Lac à la Coureuse, which is about four miles and one-half from Lac Pinz Gonke in a south-western direction. The rocks between these two lakes consist mostly of brownish quartzose gneiss with thin garnetiferous bands and lenticular hornblendic patches. A short distance north of Lac de la Coureuse they form a small anticlinal, south of which the gneiss is much twisted and folded and holds much quartz and garnet. From Lac à la Coureuse we went to Lac à l'Eau Claire all around which the reddish coarse syenite of St. Didace is exposed. This rock was traced all along the outlet of Lac à l'Eau Claire to Rivière du Loup which we descended to St. Alexis, from which place we returned to Joliette, where we arrived on the 16th of August.

Between the 18th of August and the 26th September, the World's Fair at Chicago was visited to examine the geological, mining and mineral exhibits there and thus acquire information which could not fail to be of value in prosecuting my geological work in Canada.

"From the 26th of September to the close of the season I examined the Palæozoic rocks on l'Assomption River and also the country around the village of St. Gabriel de Brandon, St. Félix de Valois and St. Damien, in order to limit certain small areas of a very highly greenish-gray quartzose massive rock, somewhat analogous to that seen on Rivière du Loup, a short distance south of the outlet of Lac à l'Eau Claire and not far from the contact of the St. Didace syenite area. This rock, as far as I could make out, must be a highly metamorphosed portion of the brownish gneiss of the district, this metamorphism being connected with the anorthosite intrusions of St. Damien.

"From the 9th to the 29th of October, I was engaged in examining the most easterly portion of my field from St. Barthélemi in Maskinongé county as far as St. Etienne in St. Maurice county. At St. Barthélemi village there are ledges of dark gray bituminous and fossiliferous Trenton limestone lying nearly flat; but there, as well as on the Chicot River, south of St. Cuthbert village, the extension of such rocks could not be traced on account of the heavy drift deposits. No outcrops of Palæozoic rocks were seen north of St. Justin village nor on the roads north of Ste. Ursule and south of St. Paulin. From Hunterstown to St. Elie and near the former place there are loose pieces of brown weathering crystalline limestone which probably come from the four-foot bed which is interstratified with the gneiss at the falls on Rivière du Loup. About St. Elie the rocks consist of grayish and brownish gneiss much twisted in places and holding quartzose bands in which garnet occurs in small bunches. This gneiss extends about four miles south.

"On Yamachiche River, and about two miles east of St. Barnabé village, ledges of gray bituminous Trenton limestone occur in horizontal beds varying from six inches to two feet in thickness. The banks of Yamachiche River vary in height from thirty to sixty feet, and are mostly composed of clay. On the road from St. Barnabé to Shawenegan or St. Boniface the rocks consist of gneiss which in one place holds impure greenish, gray limestone, full of mica, hornblende, tourmaline, etc.

"The superficial deposits south of the Laurentian hills in this area consist mostly of sand often highly coloured with iron ochre. About seventeen years ago an iron ore deposit was worked on range VII. of Shawenegan, but as the results did not prove to be satisfactory the works were soon abandoned. Iron ore occurs in many places south of

the Mattawin River, in the northern portion of Berthier, Maskinongé and St. Maurice counties, but where seen it is in small quantity and disseminated in small veins and bands of quartz felspar rock.

"Two deposits of infusorial earth occur in that portion of the province I have explored; one in the concession Trompe Souris of the parish of St. Justin, where it occurs in small quantity at a few feet below the surface in a sand bank sixty to seventy feet high near a small ravine. The other deposit which has an area of three to four square acres and a thickness of about eighteen inches is on lot 15, range V. of Chertsey; it occurs at the bottom of a marshy bay of Lac Michel.

"A few years ago in boring artesian wells near the villages of St. Justin and St. Barthélemi natural gas was met with at depths varying from sixty to eighty feet, but nowhere in sufficient quantity to be of any practical value.

"The Canada Iron Furnace Company of Radnor has raised iron ore all summer in several parishes of Joliette county, where excellent deposits are found; and this fall the company will ship about 200 carloads of ore from this locality to their works at Radnor.

"On the 3rd of November I went down to Quebec to get copies of plans of new surveys and returned to Ottawa on the 16th of the same month."

The cost of the season's exploration was \$971.13.

The work and investigations in connection with the survey of the superficial deposits was continued in New Brunswick and in part of Nova Scotia and Prince Edward Island by Mr. Chalmers who has ably conducted this investigation for several years.

In relation to this work, its value and uses, I cannot do better than quote the words of Sir Archibald Geikie, the Director General of the British Geological Survey, who says:—

"The survey of the superficial deposits thus combines a wealth of geological interest with a great deal of practical value. The geologist may find in it the solution of some problems and the presentation of many more. While the farmer, the water engineer, the builder, and the sanitary inspector may each in turn gain some practical information from it for their guidance."* As regards Canada, the lumberman may well be added to the list.

On the progress of the work during 1893, Mr. Chalmers furnishes the following interesting report:—

"After my return from the field operations of 1892 in New Brunswick, Mr. Wilson, my assistant, and I spent the winter in the office at

* Paper read before the Federated Institution of Mining Engineers, 2nd June, 1893.

our usual work. This consisted in arranging and compiling the data collected during the previous summer and laying it down on the maps (sheets No. 2 S.E., No. 4 N.W. and No. 5 S.W. of the New Brunswick series), the latter work being done chiefly by Mr. Wilson. A report on the surface geology of the area embraced in these sheets was also partially prepared, but it was found that a number of subjects required further study, especially as some intricate problems were presented for solution. Accordingly, it was thought desirable to continue the work another season before publishing the results, thus enabling us to re-examine some of these doubtful points and also finish the mapping of sheet No. 5 S.W., which includes a portion of Prince Edward Island.

"We left Ottawa on the 16th of May with the object of completing the work just outlined, and continuing the explorations in central New Brunswick on sheets No. 1 N.W. and No. 2 S.W., which had been commenced in the season of 1892.

"Investigations were first undertaken in Prince Edward Island in the area embraced in sheet No. 5 S.W. Here a very careful examination of the glacial phenomena, superficial deposits, agricultural character and forest growth was made, and a cursory survey of other portions of the island attempted with the view of obtaining the main facts relating to the surface geology. All the roads were travelled over and the greater part of the coast explored. The elevation of the country, more especially of the ridges and hills, was measured with aneroids, the readings being based on the level of the Meteorological station at Charlottetown, on the profile heights of the Prince Edward Island railway, and on tide marks along the coast.

"No evidence of Pleistocene ice having moved across the island from north to south was observed; on the contrary, the chief ice movement seemed to have been from west to east, but numerous local and divergent courses of striæ were seen trending in other directions. While thus engaged in studying the surface geology of this island, other places around the great south-western embayment of the Gulf of St. Lawrence were visited for the purpose of collecting all the facts available bearing on the questions under discussion. In the early part of July, a few days were spent at Gaspé and other points in the Baie des Chaleurs and Miramichi districts, while Mr. Wilson was left to prosecute the work in Prince Edward Island. In Gaspé Basin and at Cape Gaspé some important facts relating to the glaciation and Pleistocene changes of level were discovered. No evidence of southward moving ice was, however, found.

"On my return to Prince Edward Island, on the 18th of July, Mr. Wilson and I proceeded to the west coast, where Pleistocene fossils

occur in Leda clay or Saxicava sand. At Miminigash, a few specimens were collected at a height of twenty to twenty-five feet above the sea, and others were obtained from Leda clay or Saxicava sand at Campbellton and Cape Egmont. Sections of these fossiliferous deposits were measured and their elevation above the present sea level carefully noted.

"In the vicinity of Cape Wolf, two remarkably well defined Pleistocene shore lines occur, the heights of which were levelled with our aneroids as carefully as possible. These were traced all around the coast of Prince Edward Island.

"The result of our investigations thus far, regarding shore lines, tends to show that the Pleistocene uplift was less in Prince Edward Island than on the adjacent mainland of New Brunswick and Nova Scotia, but this is, perhaps, after all, only apparent, as the difference may be due, partly at least, to the fact that subsequent subsidence in the recent or prehistoric period was greater there. In the isthmus of Chignecto this subsidence seems to have been about eighty feet.

"On the completion of our work in Prince Edward Island, on the 4th of August, we proceeded to Cumberland county, N.S., to re-examine some doubtful points in the surface geology of the coast district bordering the Straits of Northumberland. This investigation occupied our time a week or more, after which Mr. Wilson went to York county, N.B., to continue the survey and mapping on sheets No. 1 N.W., and No. 2 S.W., which has been in progress during the last two years. On the 14th of August, I took steamer at Pictou, N.S., for the Magdalen Islands, my object being to see how the surface geology there compared with that of Prince Edward Island and the mainland. From the 15th to the 24th of August, I was on these islands and, although the weather was very unfavourable, I nevertheless succeeded in making an examination of the principal features of the Pleistocene on four of the largest of them, viz., Amherst, Entry, Grindstone and Allright. The facts obtained are of great interest and will be given in detail in my forthcoming report. No striation or boulder-clay was observed, and the surface of the solid rocks everywhere, so far as my investigations extended, is covered with rotten rock. Well marked shore lines, somewhat higher than those of Prince Edward Island, were noted. The conical-shaped hills, denuded of forest, which rise above them, seem in strange contrast to those of glaciated countries. There is a remarkable development of dunes of white sand fringing the islands and connecting some of the larger ones.

"On returning to the mainland, an examination of the reported gold-bearing deposits at Memramcook, N.B., was made. The Lower Carboni-

ferous here, in which traces of gold are said to occur, is much disturbed, the strata dipping to the east at a high angle. Bosses of granite, dolerite, etc., protrude through it, and the beds in the vicinity of these are considerably altered and contain seams of quartz, calcite, etc. Upon the upturned edges of the Lower Carboniferous lies the Millstone-grit nearly horizontally. It is in the conglomerates of the latter that a gold mine is now being opened up. A 50-stamp crushing mill has been erected, and operations are in progress. I was informed that each ton of rock yielded from \$1.75 to \$2 worth of gold.

"In the early part of September some days were spent in photographing stræ, shore lines, boulder clay banks, etc., in different parts of Eastern New Brunswick. The weather being favourable, a number of excellent views were taken, which exhibit new and remarkable phenomena.

"A further exploration of the coal seam in eastern Gloucester, near Caraquette, was made, as it was reported to me that new pits had been opened during the winter of 1892-93. These were, however, found to be partially filled with water and debris at the time of my visit, so that nothing was discovered to further elucidate the question of the thickness or quantity of coal.

"On the 20th of September, Mr. Wilson and I levelled the height of certain wellmarked Pleistocene shore lines in the vicinity of St. John, N.B. The highest of these stands, at present, 225 feet above mean tide level. We also made another examination of the boulder-clay bank on the west side of the harbour of St. John (described in Annual Report Geol. Surv. Can., vol. IV., 1888-89; Bulletin Geol. Soc. of America, vol. IV.), as the heavy storms of August had caused landslips and exposed fresh surfaces. Additional marine shells were collected from the boulder-clay.

"As some questions relating to the surface geology of the western part of the Cobequid Mountains seemed to require further elucidation, I proceeded thither on the 26th of September to re-examine the district. The glacial stræ on both sides of the range were noted, the heights of several shore lines measured, and some time was spent in re-examining the so-called "Boar's Back"—a kame stretching along River Hebert. Several features not hitherto observed in it were studied, and it now appears as if our views regarding this kame will have to be modified to some extent.

"From the 10th till the 28th of October, I was, with the permission of the Minister of the Interior, and yourself, absent attending the Columbian Exposition at Chicago.

"Mr. Wilson was engaged studying the surface geology and mapping the deposits, forest growth, etc., of York county, N.B., under

my supervision, from the 19th of August till the close of field work, except a few days during which he assisted me in levelling shore lines, copying profile heights at the Canadian Pacific Railway office, St. John, N.B., and barometric readings at the meteorological stations at Charlottetown, P.E.I., and Fredericton, N.B. He also spent two days at Halifax in ascertaining the difference between the Intercolonial Railway datum and tide level there.

"Considerable progress has now been made in the survey and mapping in York county (sheet No. 1 N.W.). The surface geology of this area was reported on by me in 1884 (Report of Progress, Geol. Survey Can., 1882-83-84), but little or nothing was done in delineating the deposits on the map. This work has, however, been in progress during the last two seasons.

"After my return from Chicago, I proceeded to Amherst, N.S., to examine the profiles of the Chignecto Marine Railway, at the office of H. G. C. Ketchum, engineer in charge. These profiles afford valuable information respecting the tidal oscillations at the head of the Bay of Fundy and at Baie Verte, in the Straits of Northumberland. To obtain the levels of the Intercolonial Railway in Nova Scotia, the profiles of that line were examined at the railway office, Moncton, through the courtesy of P. S. Archibald, chief engineer, and his assistant, W. B. McKenzie, C.E. Joseph Unsworth, superintendent of the Prince Edward Island Railway, kindly furnished me with the profile heights of the line under his charge. These and other matters occupied our time till the close of field work.

"The agricultural character of the areas explored may be briefly referred to. Prince Edward Island has long been noted for the fertility of its soil. More land fit for cultivation is found there, within a given area, than in any other part of the Maritime Provinces. It yields all kinds of grain and vegetables in profusion, and is especially suited to the production of oats, potatoes, etc. In Cumberland county, N.S., excellent farms were seen along the Straits of Northumberland, and also around the different arms or inlets of the Bay of Fundy. The Maccan River valley may be referred to as an example of a good farming district; and along River Hebert valley there are also some fertile areas.

"The agricultural capabilities of that part of York county, N.B., explored during the past two seasons was described in my report on the surface geology of Western New Brunswick already referred to.

"The forest growth of Prince Edward Island is for the most part, original, especially in Prince county, in the north-west, but the timber trees have been largely cut away. Queen's county in the central part is almost entirely denuded of forest covering and whatever remains

is of mixed growth. The lumbering business has consequently declined on the island.

"The minerals and materials of economic importance observed during the season may be briefly mentioned.

"Peat bogs are extensively developed in the north-eastern part of Prince county, Prince Edward Island, in the vicinity of Richmond and Cascumpeque Bays. They are described in Dawson and Harrington's report, printed under the authority of the Prince Edward Island Government in 1871.

"Brick-yards with kilns in operation were seen at Bloomfield station, also near Indian Point on the south side of Bedeque Bay, and a third small one near Cape Egmont.

"At Marysville, York county, N.B., an extensive brick-yard has been operated by Alex. Gibson for a number of years.

"The large deposits of bog iron ore at Manguerville, N.B., were described in my report already cited (Report of Progress, Geol. Sur. Can., 1882-83-84).

"The field investigations and mapping of the surface geology and forest growth of the three sheets 2 N.E., 4 N.W. and 5 S.W., of Eastern New Brunswick, North-western Nova Scotia and a portion of Prince Edward Island have now been brought to a close, and the preparation of these maps for the engraver will be completed at as early a date as possible. A detailed report to accompany them, which is already partly written, will now be finished.

"Mr. Wilson returned to Ottawa on the 17th of November and I on the 18th."

The cost of the season's explorations was \$1,193.93.

During the past year Mr. Faribault continued and extended the work of previous seasons connected with the detailed examination and mapping of the structural geology of the gold-bearing and associated rocks of the Atlantic coast of Nova Scotia. On this work he furnishes the following summary report :—

"According to your instructions, all the time at my disposal was devoted to the further careful study of the Cambrian rocks of the Atlantic coast of Nova Scotia and to the gold-bearing quartz veins which cut them.

"After the close of the field operations of 1892, the winter months, from the 1st of January until the 25th of May, were chiefly occupied compiling the map of the area examined. This work included the plotting of the instrumental surveys made during the summer, the revising of plotting done by the assistants, the reduction of plans from the Admiralty charts, the Crown Lands Department and other sources ;

the compiling and adjustment of these various surveys on the projection prepared by Mr. Scott Barlow on the scale of one mile to one inch, the laying down of the geological boundaries and other data gathered in the field, and finally, the study of the geology of the region which had been examined during the summer and the working out of the structure and relations of the numerous folds in these gold-bearing rocks.

"A great deal of time was also taken up preparing the manuscript maps of the county of Guysborough for the engravers, and correcting proofs of sheets Nos. 25, 26, 27 and 28 of the eastern part of the same county.

"Besides the principal work of the winter months above mentioned, a certain amount of time was taken up preparing a summary report, making a statement of expenditure in connection with field work, answering inquiries for information and preparing field maps, etc., for the following season's operations.

"From the 25th of May till the 9th of June, fifteen days, were spent, with your permission, at the Columbian Exhibition, to study the mining, mineral and geological exhibits gathered there from all nations.

"I left Ottawa on the 9th of June, for Nova Scotia to commence the season's field work. This was for the most part of a purely geological character. The first month and a half, however, was spent making a topographical survey of the country, lying west of that surveyed in 1890, and south of that surveyed in 1891. This extends from the west side of Bedford Basin and Halifax Harbour to Margaret's Bay and Hammond's Plains, comprising an area of some 200 square miles.

"The southern, and greater part of this area is occupied by a mass of granite. On its northern boundary it comes in contact with the Lower Cambrian auriferous rocks, along a line lying half way between the Margaret's Bay post road and the Hammond's Plains road; it extends eastward to Halifax Harbour, southward to the Atlantic and westward to Margaret's Bay. Apart from the granite quarries in the vicinity of Halifax Harbour, this area of granite is not of economic importance, and it was but hastily examined. In order to complete the Halifax sheet, however, a detailed topographical survey was made and the line of contact between the granite and the Lower Cambrian rocks was carefully traced.

"These latter lying north and east of the granite and extending northward to Hammond's Plains and a few miles east of Bedford Basin, were minutely surveyed and the plications of the strata carefully studied. The only anticlinal fold of importance is that passing through

the middle of Birch Cove, where its broad dome dipping westerly at an angle of 25° , is well exhibited along the shore of Bedford Basin. The auriferous quartz veins, partially prospected a few years ago, at Prince's Lodge, are situated on the north slope of this fold, and the many quartz veins met with about Birch Cove and westward along the anticline, as far as the granite mass, are certainly worth prospecting. About one mile inland on the eastern shore of Bedford Basin, along the prolongation of this anticline passing the north end of Navy Island, some mineralized barrel-quartz veins of good appearance were met with.

"The latter part of the season was devoted to the work of re-examining the gold-bearing rocks of the eastern part of the province, comprised between the rivers of St. Mary's, Musquodoboit and Stewiacke and the Atlantic coast, an area of some 300 square miles in the county of Guysborough, 900 square miles in the county of Halifax and 75 square miles in the county of Colchester. This was done in order to complete up to date the geological maps of that part of the province now in course of publication, and to study and locate with more accuracy and detail the nine or ten anticlinals into which the strata have been folded. The gold-mining districts of Cochrane Hill, Wine Harbour, Goldenville, Gegogan Harbour, Ecum Secum, Moosehead, Harrigan Cove, Salmon River, Ragged Falls, Fifteen Mile Stream, Killeag, Beaver Dam, Caribou, Moose River, Gold Lace, Mooseland, Tangier and South Branch of Stewiacke, are all situated along the anticlines. These were all visited and the new developments made since my last examination were noted. The anticlinal folds were followed along their course and the structure of each one carefully studied wherever possible, in order to locate any elevation of the axis forming a dome having the characteristic structure of a gold district. Several such domes were located, and their eastern or western dip will indicate the probable dip of the pay-streak of gold in the quartz veins.

"Numerous faults of more or less magnitude affecting the structure of these rocks were also located.

"Photographs of a few gold mines and of a number of auriferous quartz veins, some of them showing well the barrel-shape of the quartz, were taken.

"Field work closed on the 11th of December, and Ottawa was reached on the 14th of December.

"I was ably assisted for five months, as in previous years, by Messrs. Archibald Cameron and J. McG. Cruickshank.

"The expenditure on the season's explorations, including the salaries of two assistants and wages of one labourer and one cook, was about \$1,597.92."

Part of the winter, after his return to Ottawa in January, 1893, was spent by Mr. Fletcher, assisted by Mr. D. J. V. Eaton, in plotting and revising plottings by Messrs. McLeod and McLean of the surveys described in the Summary Report for 1892, page 40, and in correcting proofs of Part P., published in May, 1893, of Annual Report, vol. V., 1889-90-91, but the greater part in reducing and compiling these surveys, as far west as Parrsboro', to a scale of one inch to a mile in extension of the sheets mentioned on page 61 of the Summary Report for 1892. Between the 25th of May and the 8th of June he was studying the exhibits at the World's Fair in Chicago.

The district examined by Mr. Fletcher in Nova Scotia in 1893 comprises the eastern portion of Hants county, bounded on the south by the gold-bearing rocks, on the east by the Shubenacadie River, on the north by Minas Basin, and on the west by the Avon River. It covers an area of about 600 square miles.

Some parts of the district are well cultivated, producing apples, wheat and other grains, hay and root crops for feeding stock and dairy cattle. Ship-building has been long the chief industry of the little villages along the shores and rivers, and lumbering is carried on to some extent in the woods. Large tracts are, however, barren and useless except for the strips of hay land along the sluggish streams, some of them formed by beaver dams, the remains of which are still to be seen, although the beaver is now extinct in Nova Scotia. Moss and peat cover the treeless bogs at the head of the Tomcod River and elsewhere.

Several largely worked quarries of gypsum, the manganese mines of Tennycape, Walton, Pembroke and Cheverie, and the iron mines of Selma and Goshen are situated within this district. At Five-mile River and at Walton there are beds of red manganiferous limestone, susceptible of a fine polish, which might be used for ornamental marble; and at several places beds of good building and grindstones have been quarried.

The geological formations include (Summary Report for 1890, page 40), Triassic, Carboniferous limestones and Devonian, also small areas of igneous rocks and a tongue of the Lower Cambrian or gold-bearing slates, veined with quartz, which extends from the district of Rawdon and the Gore to the Barr and Indian Road settlements, as already pointed out by Mr. Faribault. In many places the underlying rocks are concealed by deep accumulations of drift, sand and gravel. At the Gore courthouse, Cambrian slates show glacial striæ with a direction N. 43° E., a few N. 81° E. and others S. 67° E. A short distance to the eastward, the slates are rounded and channelled in the direction N. 68° E.; while further east, near the Barr settlement, the course is S. 79°

E., and on a road also in this neighbourhood S. 52° E. Boulders of syenite and altered rocks, resembling those from the Cobequid Hills, are very abundant in the valley of the Shubenacadie River and along the Kennetcook.

A large proportion of the Triassic, as at Economy, consists of very coarse conglomerate with a calcareous cement, "vuggs" of reddish compact calcite and veins of calcite and dogtoothspar sometimes four inches thick, interstratified with brick-red sandstone and lenticular beds of limestone, nearly horizontal or with a very low dip into Minas Basin along which they form a narrow fringe. At many points Devonian rocks project through the latter, and their jagged outline makes a fine contrast with the massive or roughly flaggy Triassic beds, which are rounded and carved into pretty caves and basins by the tides. At Tennycape River, the mouth of Cambridge Creek and on the west side of Conley's Brook, the ores of iron and manganese are found at these contacts of the Triassic and Devonian, but nowhere in workable quantity.

The Carboniferous limestone formation was greatly denuded before the deposition of the Triassic and is scarcely met with on the coast; but inland it occupies several important belts and outliers, the dip being generally low, and extensive outcrops of gypsum and limestone alternate with red and green or gray marls and sandstones. Along the Five-mile River, the contact of the lowest beds with the Devonian is well seen, the former being exposed in cliffs more than 100 feet high, with a northerly dip in the main river, while reddish and gray Devonian sandstones and shales are seen in the tributaries from the south. The lowest band, a red and gray concretionary limestone, is overlaid by a great thickness of gypsum in which, on the farm of Mr. Andrew Hayes, there is a celebrated cave, seventy-five feet wide and fifteen feet high near its mouth, which is somewhat obstructed by fallen blocks of gypsum; but at 350 feet in, the cave narrows considerably. The floor is rough with blocks of gypsum and several small ponds hold the water that drips from the roof. Among numerous smaller caves, those near Miller's Creek, Kempt Shore and Cheverie may be referred to as well as the pinnacles, natural bridges, pits and ponds with underground outlets so characteristic of the plaster-land. Strong saline springs issue from these rocks at Walton, Noel Road, Pembroke, the Barkmill road and other places. North of Cheverie Creek a cliff of gypseous marl comes against the Devonian without the intervention of the limestone, indicating apparently a fault, and is succeeded immediately by the gypsum of one of the quarries, among the fissures of which a small quantity of petroleum is found, which has been described by Professor Hind in a report on the district. South of the creek the first

rocks seen on the shore are Devonian, but on this side limestone is in place and has been worked for manganese ore. The gypsum in the neighbourhood of Enoch Rhines' seems to occupy a narrow basin in the Kennetcook River and the limestone and gypsum of Selma to be in broken patches among the Devonian. One of the most persistent belts is that which is mentioned above and which extends eastward along the Five-mile River for a great distance from its mouth westward. Next to the gypsum the most interesting member of this formation is the red basal limestone, along which the manganese ores are found. It is of considerable thickness, concretionary, brecciated, and associated in places with red conglomerate and grit.

Much of the district examined is occupied by plant-bearing Devonian rocks, similar to those of Union and Riversdale, Clifton (Old Barns), and Economy, with, however, a larger proportion of grit and coarse sandstone. They are well exposed at South Maitland on the Shubenacadie River, on Minas Basin, in the branches of Five-mile River from the south, in Sterling Brook, Mungo Brook, Tennycape River and other streams. They extend north from Noel Lake to the shore road and perhaps occupy a great part of the road from this lake to Kennetcook Corner. The boulders of pyrolusite, one of which is said to have weighed 400 pounds, found one mile north of the Corner, perhaps indicate a contact with the Carboniferous limestone now concealed by drift. In the upper branches of Glen Brook, a narrow belt of hard conglomerate, sandstone and shale separates the gold-bearing slates from the gypsum; gray and red sandstone occur in Robinson Brook east of Kennetcook Corner and in the little brooks west of the Gore court-house: these perhaps represent the Devonian rocks of Union and Tennycape, but require further examination. Rocks of the Riversdale series are met with at Indian Road and the Barr settlement, and near the head of one of the branches of Nine-mile River contain thin seams of coal or coaly shale. In Rocky Brook, near Maitland, an adit was driven into the bank and several shafts sunk, one of them forty feet, in these rocks, supposed because of their dark colour and the presence of fossil plants to yield coal. A shaft was also sunk, to a depth, it is said, of sixty-five or seventy feet, between two branches of Sterling Brook, in the hope of finding silver. The explorations for coal on the small seams found in proximity to gypsum and limestone along Kennetcook River are described in the Summary Report for 1889, page 30.

On the shore immediately north of Cheverie, massive, compact and fine grained igneous rocks, of limited extent, but great variety of colour and texture, cut red and dark gray Devonian slates and extend halfway to Split Rock. In a compact variety there are veins of white

crystalline quartz with an amethystine tint. Beneath the Carboniferous limestone of the hills of Kempt shore, large blocks of gray diorite are found which perhaps indicate this rock *in situ*. The south side of Minas Basin differs from the north in no respect more strikingly than in the absence of the large masses of syenite and diorite which compose the Cobequid Hills.

At Peter Stevens', on the shore road east of Noel River, a shaft, worked to a depth of thirty feet by a horse-whim, is said to have yielded a ton of crystalline pyrolusite from a crack or vein in whitish flinty, quartzose, Devonian sandstone. The manganese ore of Minasville (Moose Brook) and Bear Brook also belongs to that class of deposits which are not in the immediate vicinity of limestone, the ore being all in red Devonian quartzite and shales or from joints, veins and blotches, varying from a quarter of an inch to five inches in thickness and holding also crystals of calcite. Nearly all the other worked deposits of manganese, however, occur in or near the limestone described above, as lying at the base of the Carboniferous formation, the ore being near the top at Cheverie, at the bottom at Walton, and in thirty-seven feet near the bottom at Tennycape mines. These are the most largely operated mines in the district, and have produced, since 1861, about 3,000 tons of "the purest and most beautifully crystallized pyrolusite found in America." It has been sold at prices varying from \$40 to \$140 per ton, chiefly in the United States, for use in decolourizing glass and in chemical processes for which only the purest ore can be employed. A number of shafts and open cuts, the deepest about 170 feet, have been sunk and a tunnel driven to drain the mine to the lowest ground. The rock, a twisted, reddish, shaly or brecciated, dolomite, is sometimes separated by two to four inches of hard red clay from the Devonian sandstone or quartzite which forms the foot-wall or floor of the mine. The ore occurs in veins, strings, nodules and masses. One of the latter is said to have yielded a thousand tons, associated with calcite, selenite, barite and limonite, but in some places almost entirely free from foreign matter. It occupies the lines of jointing and bedding, breaks apart the fragments of the breccia and replaces the shale and limestone. The latter dips S. 20° E. at a variable angle beneath a mass of gypsum; it has been worked for about 200 yards on the strike and the whole distance tested is probably less than 500 yards. It has been again found, however, on the east side of Tennycape River and traced across the Faulkner and Hill lots upon which several shafts have been sunk in a reddish, gray and blackish, calc-veined, bituminous, more or less concretionary limestone, overlaid by gypsum and in contact with Devonian rocks, which contain a quantity of pyrolusite in veins, blotches and threads.

North of Tennycap mine is the Parker mine, from which in 1881 Mr. William Stephens took about thirty tons of excellent pyrolusite. It is at present leased by Mr. Gould Northup, who late in 1893 put up a small engine for pumping, and before the fall rains stopped the work, had taken about half a ton of ore from prospecting trenches in a disturbed limestone, which apparently forms a small outlier among Devonian rocks.

At the Shaw and Churchill mine on the west bank of Walton River, immediately above the bridge on the shore road, a large quantity of pyrolusite has been found in a small outlier of red and gray limestone, like that of Tennycap. This fills a hollow in red Devonian quartzite and shale, which projects around the opening in all directions. Large masses of ore of great beauty and purity have been taken out, and a magnificent display of it is made in the storehouse at the old plaster-mill.

Bearing apparently the same relation to the last-named deposit as the Tennycap mine does to the Parker mine, is the limestone from which the ore on lots owned by the Provincial Manganese Mining Company and by Messrs. Stephens and Davis was obtained. It continues from the workings on these lots to the bank of Walton River, south of the Shaw and Churchill mine, crosses the river to "Miner" Brown's tunnel and is seen in several later excavations among small veins of pyrolusite, it then passes eastward beneath the plaster of the Walton quarries and is perhaps continuous to Hibernia, where a quantity of ore was found in reddish calcareous grit, interstratified with concretionary limestone.

Openings have also been made on another outlier of limestone in the valley of Whale Creek, between the shore and the telephone road, upon the land of Mr. Willie Weir and Mrs. Timothy Parker.

About two miles west of Walton, at the Sturgis mine, now worked by the Provincial Manganese Mining Company, ore occurs in considerable quantity as strings, veins or films, or impregnating and staining large masses both of the limestone and of the underlying flinty sandstone, in both of which shafts have been sunk and tunnels driven. The dip of the limestone is variable and high.

To the westward, at the Tomlinson mine, the limestone has not been much prospected, but openings made in the reddish, greenish and gray quartzite immediately underlying have developed a large quantity of pyrolusite and hematite, sometimes mixed, sometimes in distinct masses.

At the Lantz mine several shallow pits have cut limestone dipping about S. 32° E., from which fine specimens of pyrolusite have been obtained.

Goshen iron mine is situated at the contact of this limestone with the Devonian, just as are those of Clifton, Selma, Brookfield and the East River of Pictou. Here a mixture of limonite, hematite, barite and calcite is found in a dark gray limestone dipping S. 12° E. < 15°. A tunnel was driven 530 feet, by Mr. Browne, from the low land south of the road, but only halfway to the ore cut by the deepest shaft.

Underlying the gypsum of the Cheverie quarries is a reddish and gray concretionary limestone, from which 200 or 300 tons of pyrolusite and manganite are said to have been shipped. The ores occur in plates and veins associated with calcite.

Bog manganese occurs near Goshen, south of Cheverie, at the head of Bass Creek and at other places.

Gypsum was at one time quarried at Pitch Brook, Green Oak, South Maitland and Selma. It is still largely exported from Walton, Cheverie and the widespread deposits of Newport township, the principal quarries being those of Wentworth.

An analysis of a sample from the quarry of Mr. William Stephens, of Tennycape, was made by Professor Kennedy, of King's College, Windsor, with the following result :—

Water.....	20·60
Oxide of iron, Fe_2O_3 }	·37
Alumina, Al_2O_3 }	
Sulphuric Acid, SO_3	46·51
Lime, CaO	32·52
	100·00
Insoluble matter.....	·44

This is excellent for farming purposes and for making cement, though it is not as white as the gypsum from Wentworth and Eilershouse.

An analysis of soft plaster from Cheverie is given by the same authority as follows :—

Water and oil.....	20·78
Carbonate of lime and magnesia.	0·72
Sulphate of lime.....	78·50
	100·00

Cheverie hard plaster or anhydrite is much cheaper than gypsum; it cannot be manufactured into plaster of paris, and yields even for farming purposes slower results than the soft plaster, because less soluble in water.

Limestone quarries to supply local demand have been opened at Northfield, Glencoe, Whale Creek, Maitland, and other places.

Barite occurs in considerable quantity in veins in limestone at Walton and Pembroke.

Whetstones used for sharpening saws are reported from the quarries of gray sandstone at Scotch Village.

Brine springs and "Spa" springs are found near Hibernia, at Walton and on the west branch of Tennycapc River, the last depositing a quantity of yellow ochre. A strong spring in Robinson Brook comes probably from the outlet underground of Long Lake which is in greatly broken plaster-land.

Mr. Fletcher was assisted during the summer by Messrs. M. H. McLeod, T. S. McLean and W. B. Almon.

The expenditure on the season's surveys and explorations, including the salaries of all assistants, was about \$1,442.

Dr. Bailey, of Fredericton, assisted by Mr. W. H. Prest, has continued the explorations and surveys in south-western Nova Scotia. He reports as follows on the progress of this work :

"My attention was first directed to the completion of the investigations carried on in previous years in the counties of Queen's and Shelburne. This work included: 1, the more exact delimitation of the main granitic belt inclosing the Cambrian strata on the northern side, with the several smaller areas of granite which protrude through these strata at various points; and 2, the determination of the position, extent and structure of the various domes or anticlinal axes, so intimately connected with the question of gold mining, which mark the distribution of the Cambrian rocks. With this object in view, the entire coast region between Port Medway Harbour and Barrington was carefully examined by myself, as well as numerous islands which had not previously been visited; while at the same time an exploration of the interior was undertaken by Mr. Prest. This latter, owing to the nature of the country, and unusual drought, was a work of a peculiarly arduous character, but was successfully accomplished, including not only the accurate determination of the outline of the granite and the nature of the adjoining rocks, but also the location of the position, outlines and relations of the numerous lakes and streams found about the sources of the Port Medway, Liverpool, Roseway and Clyde rivers, with far more correctness than has ever previously been effected. In the same connection careful observations were made on the nature of the soils in the region explored, and upon the distribution of the forest trees. Finally, a detailed and measured section was made along the course of the Port Medway River from the granite

hills of Annapolis county to the Molega gold district, including a study of the structure of the latter, and of its relations to the adjoining gold districts of Pleasant River, North Brookfield and Whitebourne.

"The results of the above explorations have already been incorporated with those of previous years, in a report upon the geology of the counties named. The delineation of the geological boundaries only awaits the completion of a more accurate topographical map of southwestern Nova Scotia.

"From Shelburne county our explorations were extended into that of Yarmouth, and the data needed for the completion of a report and map of the latter have also been obtained. Contrary to expectation only Cambrian and granite rocks were found, the former, though presenting some peculiar features as the result of local metamorphism, present a sequence in every respect like that of the same system in Queen's county.

"In Digby county also the prevailing rocks are either granitic or Cambrian and their relations were pretty fully worked out through the whole distance between Cape St. Mary and the vicinity of Annapolis. Here, however, there is, in addition to the groups referred to, a belt of fossiliferous rocks, such as those which have been long known at Nictaux, Clementsport and Bear River. It was thought probable that this belt might extend westward beyond Bear River to near Cape St. Mary, and it was actually traced nearly to the great bend of the Sissiboo River, south of Weymouth, but partly owing to increasing metamorphism, and partly to the depth of the drift covering, we were not able to determine its existence beyond this point.

"In connection with the exploration of Digby county some time was spent in the examination of the volcanic rocks and associated Triassic strata; collections were made, and sent to the museum, of various quartzose and zeolitic minerals as well as of iron ores from the trappean rocks which mainly constitute the peninsula of Digby neck and Long and Briar islands."

CHEMISTRY AND MINERALOGY.

Reporting on the work of this division, Mr. Hoffmann says:—

"The work carried out in the chemical laboratory during the past year has, conformably with the practice of preceding years, been almost exclusively confined to the examination and analysis of such minerals, etc., etc., as were deemed likely to prove of more or less economic value and importance. Briefly summarized it embraced,—

"1. The examination of certain fuels, to wit, peat, lignites and coals.

"2. The analysis of natural waters—with the object of ascertaining their suitability for domestic or manufacturing purposes or probable value as a remedial agent—from respectively, the town of Joliette, Joliette county, Quebec; the township of McNab, Renfrew county, and township of Huntley, Carleton county, in Ontario; Moose Jaw in the district of Alberta, and Kamloops, in the province of British Columbia.

"3. The analysis, in regard to nickel contents, of ores from the townships of Eardley, in Ottawa county, Quebec; Hyman, in the district of Algoma; Dalhousie, in Lanark county; Somerville, in Victoria county, and Galway, in Peterborough county; also from the English River, in the district of Rainy River, and Jack-fish Lake, in the district of Thunder Bay, in the province of Ontario.

"4. The assay, for gold and silver, of ores from the provinces of Nova Scotia, Quebec, Ontario and British Columbia, and some localities in the North-west Territories.

"5. Analysis of iron ores from Annapolis and Cape Breton counties, Nova Scotia; the townships of Lutterworth, Minden and Snowdon, in Haliburton county; of Galway, in Peterborough county; and of Digby, in Victoria county; also from the district of Thunder Bay, in Ontario.

"6. The analysis of a series of marls—with special reference to their employment in the manufacture of hydraulic cement—from important deposits of this material occurring, respectively, at Marl Lake, island of Anticosti, Quebec; and in the townships of Lavant, in Lanark county; Sheffield, in Addington county; Reach, in Ontario county; and Rockwood, in Wellington county, in Ontario.

"7. The examination, and in some instances complete analysis, of several minerals not heretofore identified as occurring in Canada, certain of which constitute valuable and important metalliferous ores.

"8. Miscellaneous examinations. These include the examination, testing or analysis of brick and pottery clays, of limestones, silts and tufa, supposed to possess hydraulic properties, of some samples of bog manganese and disseminated graphite, and of other material not included under the above headings.

"The number of specimens received for identification or for the purpose of eliciting information in regard to their economic value, amounted to four hundred and sixty-three. Of these the greater number were brought by visitors, to whom the desired information was communicated at the time of their calling, or failing that—owing to a more than mere cursory examination being necessary, or when a partial or even complete analysis was considered desirable—was subsequently communicated by letter. The correspondence, chiefly in this

connection, called for the writing of two hundred and fifty letters, many of which constituted lengthy reports. The number of letters received amounted to one hundred and two.

"Mr. R. A. A. Johnston has assiduously, and in all respects most satisfactorily, carried out the work intrusted to him. Apart from a lengthy series of gold and silver assays, he has made complete analyses of many important and interesting minerals, and in addition conducted a great variety of miscellaneous work. Mr. F. G. Wait has been engaged in carrying out complete analyses of a series of marls, also in the partial or complete analysis of several natural waters, and has also made many miscellaneous examinations.

"In the work connected with the mineralogical section of the museum, I have been very ably assisted by Mr. R. L. Broadbent. He has readjusted the systematic collection of minerals, so as to allow of the introduction of species not previously represented, and also re-adjusted, in accordance with the arrangement adopted in the catalogue, the contents of certain of the cases containing the collection of economic minerals. He was further engaged in continuing the work of permanently labelling specimens already on exhibit, and in labelling and cataloguing recent additions to the collections. Further, he rendered valuable aid in assisting in the correction of proofs, at the time the catalogue of the mineralogical section of the museum was passing through the press.

"This catalogue, an octavo volume of two hundred and fifty-six pages, which was issued at the close of August last, will, it may be anticipated, prove serviceable not only to visitors to the museum, but also to those at a distance, conveying as it does a good general idea of the mineral resources of the Dominion. A revision of the "Annotated list of minerals occurring in Canada," has been entered upon and is in a fairly advanced state. This work has been rendered desirable on account of the many and important additions that can now be made to the former list.

"The additions to the mineralogical section of the museum consisted of:—

(A) The following specimens collected by members of the staff, and by Dr. F. D. Adams and Mr. Prest who were engaged in field-work in connection with the Survey:

1. Adams, F. D.:—

Magnetite from the townships of Minden, Lutterworth and Snowdon, Haliburton county, and Digby, Victoria county, Ontario

2. Barlow, A. E. :—

- (a) Gersdorffite from lot 12, range III. of Denison, district of Algoma, Ontario.
- (b) Nickeliferous pyrrhotite from the Murray mine, lot 11, range V. of McKim, district of Nipissing, Ontario.
- (c) Pentlandite from the Worthington mine, lot 2, range II. of Drury, district of Algoma, Ontario.
- (d) Six specimens of perthite and ten specimens of amazon stone from lot 7, range B. of Cameron, district of Nipissing, Ontario.

3. Broadbent, R. L. :—

- (a) Shell marl from Hemlock (McKay's) Lake, near Beechwood cemetery, Gloucester, Carleton county, Ontario.
- (b) Eighteen specimens of argentiferous galena from lot 11, range IV. of Calumet, Pontiac county, Quebec.
- (c) Sixteen specimens of sphalerite from lot 10, range IV. of Calumet, Pontiac county, Quebec.

4. Giroux, N. J. :—

- (a) Beryl from De Maisonneuve, Berthier county, Quebec.
- (b) Iron-ochre from Rivière du Milieu, Maskinongé county, Quebec.
- (c) Infusorial earth from about two miles north of Chertsey village, Montcalm county, Quebec.

5. Prest, W. H. :—

- (a) Four specimens of selenite from near Elmsdale station, I. C. R., Hants county, Nova Scotia.
- (b) Twenty-nine specimens of Thomsonite, one of jasper and one of apophyllite, all from Margaretsville, Annapolis county, Nova Scotia.

6. Selwyn, Dr. A. R. C. :—

Bituminous sand rock from the south side of Egg Lake, southwest quarter of section 30, range XXV., township 56, west of the 4th initial meridian, district of Alberta, N.W.T.

(B) And the undermentioned presentations :

1. Barlow, Scott (Survey) :—

Marl from concession IV., Rideau front, township of Gloucester, Carleton county, Ontario.

2. Brophy, G. P., Ottawa, Ont. :—

Slab of limestone showing footprint, from Hull, Ottawa county, Quebec.

3. Caldwell, W. C., M.P.P., Lanark, Ont. :—

Marl from lot 13, range IV., Lavant, Lanark county, Ontario.

4. Christie, P., Manchester, Ont. :—
Marl from Chalk Lake, township of Reach, Ontario county, Ontario.
5. De Wolf, G., Vancouver, B.C. :—
China-stone from Spatsum, district of Yale, British Columbia.
6. Garrioch, W. H. G., Hull, Que. :—
Concretionary nodule from Front Street drain, Hull, Ottawa county, Quebec.
7. Hammersley, A. S., Vancouver, B.C. :—
Roofing slate from the Jervis Inlet slate quarry, Jervis Inlet, British Columbia.
8. Haycock, E., Ottawa, Ont., per Dr. R. W. Ells (Survey) :—
Phlogopite with pyroxene from lot 13, range XI. of Hull, Ottawa county, Quebec.
9. Hayes, F. B., Ottawa, Ont. :—
Muscovite from Pied des Monts, Charlevoix county, Quebec.
10. Lewis, Wm., Holland's Mills, Que. :—
Graphite from lots 11 and 12, range III. of Portland West, Ottawa county, Quebec.
11. Mather, J., Ottawa, Ont., per Dr. G. M. Dawson (Survey) :—
Auriferous quartz from near portage from Wabigoon to Manitou Waters, district of Rainy River, Ontario.
12. Moffatt, James, Wakefield, Que. :—
Tourmaline from Wakefield, Ottawa county, Quebec.
13. McWilliams, J. B., Peterborough, Ont. :—
Pyrite and chalcopryrite from lot 30, range X. of Dummer, Peterborough county, Ontario.
14. Poole, H. S., Stellarton, N.S., per H. Fletcher (Survey) :—
Stalagmitic mass from the Acadia Coal Mines, Pictou county, Nova Scotia.
15. Röminger, Dr. Charles, Ann Arbor, Mich., U.S. :—
 - (a) Ten specimens of galena (crystals).
 - (b) Galena inclosed in limestone of secondary origin subsequent to the shattering of the Sub-carboniferous flint ledges.
 - (c) Three specimens of galena with blende.
 - (d) Three specimens of ore-bearing breccia.
 - (e) Ore-bearing breccia inclosing pieces of coal.
 - (f) Blende with galena in a calcareous cement mass, ordinary mode of occurrence of the ore.
 - (g) Three specimens of blende (crystals).
 - (h) Ruby blende.

- (i) Ruby blende with galena.
- (j) Carbonate of zinc.
- (k) Silicate of zinc.
- (l) Two specimens of calcite (crystals).
- (m) Porous silicious cement mass from which part of the inclosed blende crystals have been lixiviated by percolating fluids.
- (n) Dolomite with blende and asphaltum.

Above are all from the Joplin mines, Missouri, U.S.

- (o) Ore-bearing breccia, from Belleville, Missouri, U.S.
 - (p) Calcite with blende, from Webb City, Missouri, U.S.
 - (q) Two specimens of silicate of zinc, from Mosely mines, Newton county, Missouri, U.S.
 - (r) Ore-bearing breccia, from Mosely mines, Newton county, Missouri, U.S.
 - (s) Blende crystals imbedded in a soft calcareous mud, from the Spring City mines, Missouri, U.S.
 - (t) Carbonate of zinc, pseudomorph after calcite, from Aurora, Missouri, U.S.
 - (u) Silicate of zinc, from Aurora, Missouri, U.S.
 - (v) Blende, from Linden, Wisconsin, U.S.
 - (w) Two specimens of anglesite on galena, from Highland, Wisconsin, U.S.
 - (x) Blende, from Highland, Wisconsin, U.S.
 - (y) Blende with galena, from Mifflin, Wisconsin, U.S.
 - (z) Carbonate of zinc, from Mifflin, Wisconsin, U.S.
 - (aa) Carbonate of zinc, pseudomorph after calcite, from Benton, Wisconsin, U.S.
 - (bb) Carbonate of zinc, from Pigeon Creek, Wisconsin, U.S.
 - (cc) Carbonate of zinc, in fissures of Sub-carboniferous chert, from Cave Creek, Arkansas, U.S.
 - (dd) Carbonate of zinc, from Rush Creek mines, Arkansas, U.S.
 - (ee) Carbonate of zinc, in fissures of lower magnesian limestone from Rush Creek mine, Arkansas, U.S.
 - (ff) Carbonate of zinc, from Dubuque, Iowa, U.S.
16. Rutledge, J., Ottawa, Ont. :—
Muscovite from lot 16, range II. of Calvin, district of Nipissing, Ontario.
17. Selwyn, Admiral J. H., London, Eng. :—
Gilsonite from Utah, U.S.
18. Shaughnessy, F. G., Montreal, Que. :—
Polished cube of black limestone from the Château Frontenac, Quebec City, Quebec.

"Mr. C. W. Willimott was engaged in the early part of the year in arranging, cataloguing and packing the collection of minerals intended for exhibit at the World's Columbian Exposition. On the completion of this work he proceeded to Chicago to attend to the unpacking and assist in the instalment of the same. The duties assigned him called for his presence during the whole period that the exhibition was open. At the closing of the same he assisted in the repacking of the collection in question and further, by permission of the Commissioners for Ontario, British Columbia and Quebec, in selecting from the exhibits of these provinces such specimens as were considered desirable for the forthcoming Antwerp Exhibition. The packing of the whole of this material, which constituted over 300 cases, boxes and barrels, and the making out in duplicate of the necessary invoices and clearance papers for the United States customs, was attended to by Mr. Percy H. Selwyn, who having completed this work left Chicago on the 8th of December and arrived in Ottawa on the following day.

"Mr. Willimott returned from Chicago on the 25th of December.

Mr. W. F. Ferrier, lithologist, reports on the work of the past year as follows:—

"At the beginning of the year I was still engaged, assisted by Mr. Percy Selwyn, in the preparation of a preliminary list of the rock specimens in the drawers under the museum cases, but on the 18th of January, having received instructions to prepare a stratigraphical collection of Canadian rocks for exhibition at the Chicago World's Fair, work on this list was, for the time being, discontinued, and the Chicago collection at once commenced.

"My time was fully occupied until the 3rd of April in this work, and I was ably and energetically assisted by Mr. Percy Selwyn in preparing a manuscript catalogue of the specimens. The preparation of this collection involved the selection, trimming, labelling, naming, arranging and cataloguing of 1,500 specimens of rocks, illustrating all the geological formations known to occur in the Dominion of Canada, from the Laurentian to the Pleistocene.

"After the collection had been shipped to Chicago it was decided to print the manuscript catalogue which accompanied it, and the greater portion of my time for about a month was occupied in the necessary rearrangement of manuscript and in proof-reading. It was published under the title:—'Catalogue of a Stratigraphical Collection of Canadian Rocks prepared for the World's Columbian Exposition, Chicago, 1893.' It forms a royal octavo pamphlet of 150 pages. Three thousand copies were printed and many were distributed at Chicago to those interested. Copies were also sent to all institutions and individuals on

this department's list of exchanges, and the remaining copies will be available for use here, as it is intended to place the collection in the Museum, now that it has been returned from Chicago.

"My acknowledgments to my colleagues on the Geological Survey for their hearty co-operation and assistance have already been expressed in the preface to the above mentioned catalogue, and I take this opportunity of repeating them. Owing to the short time at my disposal, much work after office hours was necessitated, and these gentlemen did everything in their power to aid me, several of them kindly volunteering to work in the evenings at the museum.

"Several letters have been received from well-known scientists abroad, and handed to you, referring to the information they had derived regarding the rocks of Canada from a study of the collection, and in two cases asking that samples and drawings of the labels, cases, and other museum appliances used by this Survey, be supplied them, as they had decided to adopt the same in the institutions which they represented.

"Although so much of my time has been taken up this past year by the work above referred to; good progress has been made in the microscopical study of the Archæan rocks collected by Messrs. A. F. Barlow, E. D. Ingall and J. B. Tyrrell, and it is hoped to have the reports on these completed at an early date.

"Some fifteen thin sections of rocks have been examined for Dr. Dawson and reported on, and microscopic examinations of a large number of British Columbia rocks have from time to time been made for him. The total number of thin sections of rocks prepared and received during the year was twenty-seven, but in addition to these, 102 specimens were sent to Germany, and nine to the United States to have thin sections prepared from them. These have not yet been received.

"Two thin sections and a hand specimen of an interesting olivine-pyroxene rock, Harzburgite, were purchased in Germany for comparison with a similar rock, collected by Dr. Dawson in British Columbia. Of the specimens in the Chicago collection, ten were polished and four were slit to reduce their size or to show peculiarities of structure.

"Early in January, a collection of 115 thin sections of crystals of the more important rock-forming minerals, purchased from Messrs. Voigt & Hochgesang of Göttingen, Germany, was received, and has proved to be a most valuable addition to the equipment of the lithological laboratory.

"A large series of rocks collected by myself in 1891, from the Eastern Townships of Quebec, was carefully gone over, packed, and placed in store. As usual, a considerable amount of work of a miscellaneous

character has been done, including blowpipe determinations of various specimens submitted to me.

"On the 16th of September, in accordance with instructions received, I left for Chicago, remaining there until the 4th of October, during that period assisting and giving information to those who wished to study the mineralogical and lithological collections exhibited by this department, and also examining the foreign exhibits bearing on my own work. Since my return until the close of the year, my time has been mainly occupied in microscopical work. The specimens in the upright cases containing the stratigraphical collection of rocks were removed and packed carefully in boxes, this being rendered necessary by the extensive repairs which the museum is undergoing. Thirty official letters were received during the year and thirty-six written.

"Expenditure during the year, \$130.25."

MINING AND MINERAL STATISTICS.

Of the work of the division of Mineral Statistics and Mines, Mr. E. D. Ingall, the officer in charge, gives the following particulars :

"From the date of the last summary (31st December, 1892), the office work of the division has been carried out as usual. The time of the staff was occupied in collecting and compiling statistics of the mineral production, and general information regarding the mineral resources of the country, as well as of mining operations and discovery, and in answering inquiries for such information and in office routine.

"In January, 1893, sickness necessitated my absence from duty. Thus the work necessarily fell greatly behind. On my return from sick leave in February, special and urgent work in connection with the preparation of the exhibits of views and maps for the World's Fair at Chicago, called for the co-operation of the whole staff of the division. Four large maps of the Dominion showing the distribution of the deposits of economic minerals were prepared. The localities were largely taken from the Directory of Mineral Occurrences, on which the staff of the division has been at work from time to time as other work allowed.

"These were represented on the map by means of a systematic series of conventional signs prepared by myself with your approval. The collections of rocks made by the various officers of the division were unpacked and gone over in order to select a representative series for addition to the systematic collection prepared for Chicago.

"This work having been disposed of, attention was directed to the annual report of the division for 1891, which would have been attended

to several months previously, but for the combination of circumstances above detailed.

"On the 13th of April, the Preliminary Summary of the Mineral Production of Canada, was completed, sent to press and distributed shortly afterwards.

"During the early part of the summer season, my whole time was taken up in putting the before-mentioned report through press, in proof-reading, etc., and in office routine work.

"From the 21st of June to the 3rd of July, I was in the Sudbury and Sault Ste. Marie districts, accompanied by Mr. H. N. Topley, directing the taking of photographs of the mines for our series of mining photographs and obtaining general information as to mining and mineral development in the district. Steps were taken which it is hoped will obviate the difficulties which have been experienced in the past in getting returns from some of these mines.

"The three chief operators in the Sudbury district, viz., the Canadian Copper Co., the Dominion Copper Co., and Messrs. H. H. Vivian & Co., were still, as in previous years, mining ore and shipping matte. The Travers mine was visited, but no underground work had been done there since the 1st of February, 1893, all the efforts being directed to completing and improving the surface works.

"Besides the nickel mines above named, two companies were operating on the gold-bearing veins of the district, viz., at the Creighton mine near Larchwood, west of Sudbury, on the Canadian Pacific Railway, and the Ophir mine near the Bruce mines, on the Algoma branch of the same railway. At both these mines underground exploratory work was in progress and mills were being erected for the extraction of the gold.

"On my return to the office, the proof-reading of the Report for 1891 was completed, the last forms having been signed for press on the 14th of August. I was then occupied at Chicago in connection with the 'World's Fair,' from the 24th of August to the 12th of September, whilst from the 18th of September to the 2nd of October my time was occupied in the field in connection with working out the distribution of the rocks of the area included in the lower or south sheet of the map illustrating the investigation of the River du Lièvre and Templeton phosphate districts, begun by myself, assisted by Mr. White. This work had to be done piecemeal as intervals occurred in the other work.

"Up to 1893 Mr. White had only assisted by carrying out the topographical surveys necessary to construct a map of the district whereon the results of the mining-geological investigations might be shown and in compiling the map in the office. In view, however, of his increasing interest and experience in geological work, I instructed him to move his

party to Ottawa county and endeavour to finish the tracing out of the distribution of the various lithological subdivisions constituting the Laurentian, of the district under investigation. Our work this season thus brings to a conclusion the field work for this investigation, but the office work necessary to work out and report upon the results of these observations yet remains to be completed.

‘ My time being very fully occupied with the work proper of the mining division, I had planned to work at the above during the evenings of last winter. The complete reversal of all my plans by sickness and family trouble last winter prevented this, and the arrears of the division work will have to take precedence. I still hope, however, that I shall find intervals which may be utilized in completing this work.

“The series of microscopic sections made from rock specimens collected are in the hands of Mr. Ferrier, the lithologist, for detailed examination. I found a little time in the spring to work with him at the sections, but since then the matter remains in abeyance.

“ Mr. Brumell reports on his summer’s work as follows :—

“ ‘ I left Ottawa on the 18th of June, going direct to Windsor, where inquiries were made regarding the boring operations going on in search of natural gas in Essex county. After visiting various points in the county I went to Ridgetown, where natural gas has been in use for some time. Here it was found that the whole town was being supplied from shallow wells in the vicinity, which afford large quantities of practically odourless surface gas, some wells affording as much as 5,000,000 cubic feet per day. There have been about 150 wells sunk, many of which are of course valueless, while about thirty of them produce largely. Those of greatest capacity are nearly all in the vicinity of the town and on the southern side, those to the northward affording the least flows. The record of one of the McMaster Bro’s. wells is as follows, and may be taken as a fair index of most of those in the vicinity of the town :—

Surface soil.....	6 feet.
Gravel with water.....	23 do
Clay.....	57 do
Hard-pan.....	2 do
Fine white sand and gravel, with gas.....	

“ ‘ The hard-pan ranges from two to fourteen feet thick, beneath which is found the white sand and gravel to a depth of from six inches to thirteen feet and from which the gas is obtained. The wells are all “drive wells” of three and one-half inch pipe, and have an initial pressure as high as fourteen and a half pounds. About eight miles

of one, two and three inch mains with regulators, are laid throughout the town, and the gas is being used in all factories, and in many private residences, shops and hotels. This gas-bearing sand covers a large area, extending from Ridgetown to the south-west as far and perhaps further than Rondeau on Lake Erie. At Blenheim, a few miles west of Ridgetown, an effort was made to find deep-seated gas, and a well was sunk to the depth of 1,300 feet without success.

“From Ridgetown I went to St. Thomas, where Mr. John Campbell had started a deep well in search of gas and had just succeeded in finding bed-rock (Hamilton shale) at 285 feet without encountering gas.

“From St. Thomas I went to Petrolea, where I obtained considerable information regarding borings in different parts of the province as well as records of several wells sunk in past years. Thence I proceeded to London, Buffalo, Port Colborne and Hamilton, obtaining in all these places records of borings and general information regarding wells in the vicinity, as well as correcting the directory lists of mineral producers throughout the province.

“On the 22nd of July I left my work to attend the World's Fair in Chicago, where I remained until the 1st of September, the length of my visit being necessitated through the absence of Mr. Willimott on urgent personal business.

“I returned to Ottawa on the 5th of September, leaving again on the 11th in company with Mr. H. N. Topley, with whom I visited all the more important abandoned and operating mines in Hastings county, Mr. Topley making photographs of a number of them while I made such notes of their history and of general interest as were to be obtained. In this way we visited the Sexsmith, Richardson and Wallbridge mines in Madoc township, the Consolidated, Fiegle, Gladstone and Twenty acres mines in Marmora, the Carscallen and Ledyard gold mines, the Belmont, Bessemer Ore Company's mine and the Blairton mine in Belmont, as well as the lithographic stone quarry in Marmora township, the Emily mine in Tudor and the Coe Hill and Jenkins mines in Wollaston. Of these the only ones in operation were the Twenty acres, Carscallen and Ledyard gold mines and the lithographic stone quarry in Belmont and Marmora.

“At the Twenty acres, lot 8, range VIII., Marmora, there are two inclined shafts sinking on the vein which is about two feet wide, dipping to the south-west at an angle of about 38° gradually flattening to about 22°. The vein has been followed to a depth of seventy-five feet in No. 1 shaft, showing good ore between clean walls the entire distance. The ore is composed of pyrite and mispickel in a gangue of quartz.

“The Carscallen mine on lot 20, range I. of Belmont, owned and operated by the Moira Gold Mining Co., of New York, owing to an accident to the mill, was temporarily closed, at the time of our visit. It was expected, however, that operations would shortly be resumed. The works here consist of three shafts and two open cuts, one (the main shaft) being 132 feet deep and the Strickland shaft, the most easterly, thirty feet, while the O’Neil on a cross vein to the south of the Strickland, is about thirty-five feet. The main vein at the main shaft is about two feet wide, striking N. 80° W. with a slight dip to the south while at the Strickland the vein has widened to eight feet, dipping to the south at an angle of 68°. The vein at the O’Neil shaft is ill defined and from twenty to twenty-five feet wide, striking N.N.W., and dipping approximately vertically and affords about thirty per cent of good mill ore, well mineralized and rusty in appearance. The ore on this property appears to be but slightly arsenical. It consists almost entirely of pyrites carrying gold in a quartz gangue. The machinery in connection consists of one Blake’s crusher and feed, two Crawford mills and plates, engine and boiler.

“At the Ledyard gold mine on the east half of lot 19, range I., Belmont, exploratory work was being carried on, and consisted of an open cut about forty feet long in the end of which a shaft had been sunk thirty-five feet on the vein, which measured six feet in width at the surface, striking N. 65° E., and dipping to the south at an angle of 60°. The ore is quartz carrying pyrites, with a small proportion of mispickel and free gold. The free gold occurs more abundantly in the rotten honey-combed quartz and “gossan” on the surface. The work was being prosecuted by six men, and of the ore mined, thirty-seven tons had been hand-picked, barrelled and shipped.

“The Ledyard Iron mine on the west half of the aforementioned lot is owned by the Belmont Bessemer Ore Co., and was at the time of our visit idle, the cuts and workings being full of water. The ore, of which about 500 tons were on the dump, consists of magnetite about fifty per cent of which is somewhat sulphurous. An assay of a lot of 100 tons sent to the Cambria Iron Co., showed the ore to contain :—

Iron, metallic.....	61.75 per cent.
Phosphorus.....	.023
Sulphur.....	Not given.
Silica.....	7.48

“An assay of the above made by the producers showed sulphur to the extent of .497 per cent.

“A large boarding-house, stables and engine-house were erected at the mines and a roadway built to Marmora at a cost of \$30,000, though no rails were laid.

“A visit was made to the lithographic stone quarry, owned and operated by the North American Lithographic Stone and Asbestos Co., of New York, on lots 7 and 8 in range III., and 7 in range II. of Marmora. The quarry is situated on the south side of Crow Lake near the water's edge and covers an area of forty-five by 100 feet. In the development of the quarry five or six beds of good stone have been found, a few blocks of which have been planed and shipped, and the intention of the company is to ship all sizes from twelve by twenty to thirty-six by fifty-two inches.

“The Crescent Gold Mining Co. own and, until quite recently, operated the Gladstone and Fiegle properties, consisting respectively of lots 17 and 16, range XI., Marmora. The operations consist of several open cuts and strippings and two shafts ninety and sixty feet each, cutting diagonally across the several stringers and leaders which go to make up the mass of vein-matter constituting the main ore body. The various veins opened up are said to have afforded some very rich stuff, more especially in the rotten and weathered portions over the surface. The mill and plant in connection with the mine are in first class condition, and include one Blake crusher, ten stamps, two automatic feeds, two amalgamated plates and one improved Frue vanner, engine and boiler.

“In Marmora village the Hastings Mining and Reduction Co., of Toronto, have erected and are now running a small custom mill, and state that very good results are being obtained. The mill is run by water-power and contains one Blake crusher, one Griffin mill, one Walker and Carter roaster, one amalgamator, three collecting pans, one settling pan, two arsenic condensers and drying floor. The company claims to have proved beyond doubt that the arsenical ores of the district can be successfully and profitably milled and if so the success achieved by this company should lead to the reopening of many of the promising gold veins of this district.

“At Millbridge we obtained considerable historical information regarding the many lead and iron properties at one time operated in Tudor and Lake townships.

“From Bancroft we took several short trips into Wollaston, Mont-eagle, Faraday and Herschel townships, visiting several deposits of phosphate and mica. Nothing has as yet been done beyond locating the various properties, on none of which, however, are the deposits of very great commercial value. The mica deposits visited were at L'Amable in Dungannon township and north of Bird Creek in Mont-eagle.

“On the 29th of September Mr. Topley returned to Ottawa, while I went on to Toronto, where on the 4th of October I was joined by

Mr. L. L. Brophy of our staff, in company with whom I went to Essex county. We were engaged there in levelling and reducing to common datum most of the many wells sunk in search of natural gas, as well as in collecting all the information we could procure regarding boring operations. From this county we went *via* Ridgetown and St. Thomas to Welland county. We there obtained the levels of all wells in Bertie and Humberstone townships, as well as information regarding the distribution and occurrence of natural gas and petroleum in the Welland field. On the 14th of November, Mr. Brophy returned to Ottawa, while I continued my observations visiting Hamilton, St. Thomas, London, Windsor and Toronto.

“At Hamilton the local company had struck small flows of gas in their second well at the depths of 400 and 500 feet, they were, however, but short lived. The first well was sunk to a depth of 1,950 feet at which point granite was struck; in the Trenton limestone at a depth of 1,830 feet a little flow of gas was noted.

“At St. Thomas the boring had been carried to a depth of 1,640 feet, at which point the drill was in the Medina formation where a very small flow of gas was found. Work was suspended, but it was expected would very shortly be resumed and the boring carried to the Trenton formation.

“I returned to Ottawa on the 24th of November, when I resumed my office duties.’

“Mr. White reports of his summer's work, as follows :—

“I left Ottawa on the 28th of May for Chicago to study the mining and geological exhibits at the World's Fair, returning on the 15th of June. Mr. J. H. Featherston, B.Ap.Sc., had been instructed to commence the chaining required to correct the inaccurate surveys of some of the townships included in the area under examination. A compass and chain survey was carried northward from the village of Portland in Leeds county through Lanark to the village of Calabogie, in the southern part of Renfrew county, and another from Flower station in Lavant township, southward through part of Lanark and Frontenac counties, to Sharbot Lake junction. Mr. Featherston was engaged in this work from the 1st to the 22nd of June, when he joined Mr. White at Harrowsmith.

“Mr. White then commenced a transit and chain survey to connect Sharbot Lake junction with the city of Kingston, as the latitude and longitude of the latter have been accurately determined. On the completion of this work, as it was deemed advisable to make a reconnaissance of the southern part of the district, the party was transferred to Perth, on the 1st of July, and a geological examination made of the

lakes and connecting streams of the Rideau Canal to the edge of the Cambro-Silurian rocks in the vicinity of Kingston. Side traverses were also made to some of the larger lakes in the vicinity of the Rideau waters.

"Returning to Westport on the 21st of July, the chain of lakes extending from there to the Kingston and Pembroke Railway, viz., Sand, West Rideau, Bobbs, Eagle, Long and Sharbot Lakes were examined geologically. Four large granite masses and several smaller ones were found, notably one near the Chaffey and Matthew's iron mines in the townships of North and South Crosby, another between Eagle and Long Lakes in the townships of Hinchinbrook and Olden, and others in North Burgess and the central part of Storrington townships. The latter was observed by Mr. Alex. Murray in 1851, and supposed, by him, to occupy only a small area in and near the village of Battersea, where it is capped by the sandstones and limestones of the Cambrian and Cambro-Silurian formations. The investigations of last summer, however, showed that, emerging from under the fossiliferous formation, it extends about four miles to the north-eastward, occupying the country between Loughborough and Dog lakes.

"The Eagle Lake mass of syenite was not fully delineated, but appears to occupy a large area in the western part of Hinchinbrook township, and it may possibly join the mass of the 'Red Mountains' in the adjoining township of Sheffield. Further exploration, however, will be required to decide this. The close proximity, usually from 100 to 200 yards, of iron deposits to these igneous masses has been well shown on Mr. Coste's map of the Madoc and Marmora mining district, hence the importance of delineating them, and thus giving the clue to further discoveries.

"Numerous bands of crystalline limestone were traced, notably the great Dalhousie-Lanark band which was traced from its western termination in lot 22, con. XI. of Olden township, through Oso, Bathurst and Dalhousie to the Dalhousie-Lanark town line. From this point it extends in a north-easterly direction through the townships of Lanark and Ramsay, in the former of which it attains its maximum width of eight miles.'

"On the 18th of August it was decided to move to the Ottawa county, Quebec phosphate district, to complete the work on the south sheet of the map of that district. This was accordingly done and the work carried to completion.

"Mr. White returned to Ottawa on the 6th of October.

"During the greater part of the season he was ably assisted by Mr. J. H. Featherston, B.Ap.Sc., Mr. H. W. Mussen also acted as assistant from June the 22nd to Sept. the 13th.

"Since the return of the various members of the staff from the field their time has been occupied with the usual office work."

The expenditure on the field work of the division amounted to \$2,401.11.

PALÆONTOLOGY AND ZOOLOGY.

Mr. Whiteaves reports on the work in this branch as follows :

In the early part of the year he was engaged in a study of the gasteropoda of the Trenton limestone of Manitoba. The results of this study are embodied in a paper published in the 'Canadian Record of Science' for April last, in which fifteen species are identified and enumerated and one described and figured as new.

On the 23rd of May last it became his duty to deliver the presidential address before that section (Section IV.) of the Royal Society of Canada, which is devoted to the Geological and Biological Sciences. The topic selected for consideration on this occasion was 'The Cretaceous System in Canada.' The address consisted, first, of an exhaustive summary of the work that had been done by other labourers in this field of inquiry previous to the confederation of the provinces in 1867, and secondly, of a succinct epitome of the subsequent investigations, by members of the staff of the Survey and others, up to the present time, into the geographical distribution, stratigraphical relations, palæontology, and economic products of the Cretaceous rocks of Manitoba, the North-west Territories, the Rocky Mountain region, British Columbia, and the Yukon district. It makes a paper of seventeen pages quarto, which has since been published in the eleventh volume of Transactions of the Society, and separate copies have been widely distributed on this continent and in Europe.

On the 14th of July last, Mr. Weston was so fortunate as to discover two unusually large remarkable Unio-like shells in the productive Coal-measures at the South Joggins Coal field. A paper descriptive of these specimens, which are believed to represent a new and extinct genus of Unionidæ, for which the name *Asthenodonta* is proposed, was prepared and has since been published, with illustrations, in the eleventh volume of Transactions of the Royal Society of Canada.

The members of the Natural History Society of British Columbia have kindly forwarded, for examination and comparison, the whole of their collections of the fossils of the Cretaceous rocks of Vancouver and the Queen Charlotte Islands, and Dr. C. F. Newcombe has obligingly supplemented these by some additional specimens from rocks of the same age, collected by himself, in 1892, on the Comox River, V.I. Among the former are two new species of Ammonites from the Queen

Charlotte Islands. These Mr. Whiteaves has since described with an illustration in the October number of the 'Canadian Record of Science,' published in Montreal; and among the latter is a specimen of a new cycadaceous fruit which has recently been described by Sir J. W. Dawson. The types of the two new species of Ammonites, and four other fossils which gave some additional information about species that had previously been described, have now been presented to the museum of the Survey by the members of the Natural History Society of B.C., in return for a named series of other fossils from that province, and the remainder of their collection has been named and returned. The type of the new cycad fruit and a set of the most interesting fossils from the Comox River, have been presented to the museum of the Survey by Dr. Newcombe.

A paper entitled "Notes on some marine invertebrata from the coast of British Columbia" has been written for the 'Ottawa Naturalist,' and published in the December number of that periodical. The fourteen species referred to therein were collected by Dr. G. M. Dawson and Professor Macoun.

The second part of the third volume of the "Palæozoic Fossils" of Canada is intended to consist of a descriptive and illustrated report upon the fossils of the Guelph formation of Ontario. A considerable portion of the letter-press of this report has been written, and it is hoped that the whole of it will be ready for publication early in the spring of 1894. With a view to making the list of species as complete as possible, the writer spent a few days in the early part of September in collecting the fossils of the Guelph formation at Belwood and Elora, and succeeded in obtaining several specimens of unusual scientific interest at these localities.

In Zoology, one hundred birds and two mammals have been skilfully mounted by Mr. S. Herring, who has also performed the usual annual cleaning of the whole series of stuffed mammals and birds. Important and extensive collections of the recent vertebrata and marine invertebrata of the coast of British Columbia have recently been made by Professor Macoun, but these will be referred to in more detail in his report. Apart from these, the most interesting specimens added to the museum during the past year are a nearly complete skeleton of the Great Auk (*Plautus impennis*), from Funk Island, presented by the Smithsonian Institute: a skeleton of an adult male fur seal (*Otaria ursina*, *Callorhinus ursinus*), from Behring Island, presented by Mons. N. Grebnitzky in 1891; a mounted adult female of the same species, from the North Pacific; and a series of Alaskan birds, most of which were collected by Mr. J. M. Macoun. Among the latter are fine examples of the Aleutian and Prybiloff Sandpipers (*Tringa Gouesii*

and *T. ptilocnemis*), the Emperor Goose (*Philacte canagica*), Steller's Eider (*Eniconetta Stelleri*), the Parroquet, Crested and Least Auk (*Cyclorhynchus psittaculus*, *Simorhynchus cristatellus*, and *S. pusillus*). The bones of two or more individuals of Stellers Sea Cow (*Rhytina gigas*) from Behring Island, presented by Mons. Grebnitzky, in 1891, and referred to in a previous report, have recently been unpacked and are now on exhibition in the museum. They consist of one imperfect skull, six cervical and sixteen dorsal vertebrae, two scapulae, two humeri, one ulna, two radii, one sternum and five ribs.

During part of the time that the director was absent from Ottawa, at the World's Fair, or on field work, the duties of acting director were performed by me, and, in addition to the correspondence entailed thereby, about 250 official letters have been received and about 164 written.

Mr. T. C. Weston reports that he spent most of the first three months of the year in preparing the following collections for exhibition at the World's Fair, at Chicago. 1. Two cases of specimens of *Eozoon Canadense*, from the Laurentian rocks of the Dominion. These consist of decalcified and other specimens, microscopic sections, microphotographs and drawings, all of which required much care in preparing. 2. One case illustrating the methods employed by the Survey in labelling and exhibiting geological specimens in the museum. 3. One case containing a series of specimens, neatly re-labelled and re-arranged, of native gold, or of models of gold nuggets from the Chaudière, etc. 4. A series of 150 hand specimens of the fossiliferous rocks of the Dominion, which were incorporated with the large stratigraphical collection.

Part of July and August was spent in field work in the provinces of Nova Scotia and Quebec. A large and interesting series of fossils, including the two large Uniolike shells already mentioned by Mr. Whiteaves, was obtained from the Carboniferous rocks of the South Joggins coast, and an important series of graptolites from the Cambro-Silurian shales at Point Lévis.

The remainder of his time, up to date, has been spent in museum work in the palæontological and ethnological branches, in preparing and labelling new specimens for exhibition in the cases, in making microscopical sections of rocks and fossils, and in developing and preparing specimens for study or exhibition.

Dr. Henry M. Ami reports that during the earlier months of the year he was engaged in selecting from among the Survey duplicates, naming and arranging a systematic collection of Canadian fossil remains

for the World's Columbian Exposition. This collection formed an attractive and instructive feature of the Canadian geological exhibit in the Mines and Mining building, and was without exception the largest and most comprehensive palæontological collection in that building, consisting, as it did, of 2,448 specimens of 597 species. In this work Dr. Ami was efficiently assisted by Mr. Harold B. Cushing, B.A. In connection with the collection of rocks Mr. Ami named 373 fossiliferous rock specimens, as is stated on page xiii of the catalogue mentioned, page 48 of the present report.

Classified and systematic lists of fossils from the following localities were prepared as follows:—

Bord à Plouffe, Que. ; Grande Ligne Quarry ; St. Martin's Junction, Que. ; Ross's Quarry, Little Rideau, six miles east of Hawkesbury, Ont. ; Murrays' Quarry, Ont. ; Butler's Quarry, four miles west of L'Orignal, Ont. ; Stone Fence (loose), a mile and a half west of L'Orignal, Ont. ; Clarence Creek, near Rockland mills, county of Russell, Ont., collected by Drs. Ells and Deeks in 1891 and 1893.

Three collections of fossils, of Trenton and Chazy age, made by Mr. Lambe, 1891, at two quarries near L'Orignal and Hawkesbury, Ont.

Dudswell and Famine River collected by various officers of the Survey from 1860 to 1886. These indicate clearly and conclusively the occurrence of Devonian rocks along the Famine River, Que., as previously determined by Mr. Billings; *vide* page 428, *Geology of Canada*, 1863.

Seventy specimens from the Bear River beds, Nova Scotia, near great bend of the Sissibou River; from Mistake Settlement, county Digby, N.S.; and from the Nictaux iron ore beds, N.S., collected by Prof. Bailey in 1893 and by T. C. Weston in 1872.

Graptolites from Point Lévis, Que., collected by Mr. Weston in 1892.

For Sir Wm. Dawson:—Specimens from the Utica and Chazy formation—sent from the Peter Redpath Museum for identification. These include fossils from the Island of Montreal, Lake Memphremagog and Little Métis, Que.

Fossils from the Yamaska River, one mile and a half below mouth of Salvailles River, near St. Hyacinthe, Que., collected by Mr. Giroux in 1890, and from Rougemont and Rivière des Hurons, P.Q., collected by T. Curry in 1872.

Miscellaneous. Collections of fossils from Les Îlets and Pte. aux Trembles, Que.; from Cobourg, Russell county, Ont., Lot 16, Con. II. made by J. Richardson, in 1853; from the Ottawa district in collections made by Dr. Ami at Hog's Back, Rockland, Hull, Ottawa and Gloucester, and a preliminary examination of fossils collected at various

localities in the counties of Hastings and Frontenac, Ont., by Mr. James White, C.E.

Two collections of coal plants from the Lower Carboniferous of Pictou county, N.S., and from the "conglomerates at the base of the Millstone Grit" of Middle River, both sent by Mr. H. S. Poole, F.G.S.

Fossils from the Albion Mines, Back Pits, Deep Coal Seam, Pictou, N.S., ironstone balls or nodules collected by Hugh Fletcher, 1892, also, fossil remains from West Advocate, Cumberland county, N.S., Hugh Fletcher, 1892.

Graptolites from near Hamilton, Ont., collected by Col. C. C. Grant, Hamilton, Ont.

Systematic lists of fossil remains for labelling specimens in the Museum from the Trenton of Manitoba, the Sillery of Little Metis, the Leda Clay of Green's Creek, etc., were prepared at various times.

Besides the World's Fair collection of fossils already mentioned, Dr. Ami selected and forwarded collections to the following institutions during the year.

Toronto University :—302 specimens comprising seventy-five species of Devonian fossils illustrating Mr. Whiteaves' memoir—"Contributions to Canadian Palæontology," vol. I., part 4.

Redpath Museum, Montreal :—Devonian fossils from Manitoba, to illustrate the same report.

Provincial Museum, Victoria, British Columbia :—Upwards of one hundred specimens of fossils, chiefly Cambrian and Cretaceous, from the province of British Columbia.

"Muséum Royal d'Histoire Naturelle de Belgique," Brussels, Belgium :—In exchange for two volumes of De Koninck's illustrated folio monographs of the Carboniferous fossils of Belgium, 219 specimens of Devonian fossils, including 438 species.

Musée Rémy, Marcuil-le-Port (Marne), France :—Sixty-eight specimens of twenty-three species of Canadian fossils sent to the Rev. Dr. D'Orban, late of Montreal, Que.

A small series of Tertiary and Cretaceous ostracoda from Manitoba and the North-west Territories was sent to Professor T. Rupert Jones, who is the best living authority on these minute and obscure organisms, for examination and description.

A small collection of middle Cambrian fossils from the Rocky Mountain Park has been selected for Mr. J. Townsend, of Toronto, in exchange for Guelph fossils. A few type specimens were loaned to Mr. G. F. Matthew, of St. John, N.B. These have been returned, and in acknowledgment he has kindly presented to the Museum a series of Cambrian fossils from St. John City, New Brunswick.

Dr. Ami has prepared a scheme for cataloguing the Palæontological division of the Museum. He has also determined and classified, during the summer months, most of the Cambrian material from Mount Stephen and the Rocky Mountain region—besides a few fossils from the middle Cambrian of the Selkirk Range, near Donald, B.C. Of these, the best specimens have been placed in the Museum cases.

Mr. Lambe reports that copies of his first paper, on "Sponges from the Pacific Coast of Canada and Behring Sea," illustrated by four full sized plates, were distributed in the early part of February; this paper was published in the tenth volume of the 'Transactions' of the Royal Society of Canada, 1892, and was descriptive of the dried specimens in Dr. G. M. Dawson's (1885) collection.

During the first part of the year, until the middle of April, he was engaged in the preparation of a second paper, on a number of siliceous and calcareous sponges, collected by Dr. G. M. Dawson, in 1885, from the waters surrounding Vancouver Island and the Queen Charlotte Islands. The sponges that form the subject of this paper, entitled, "Sponges from the Pacific Coast of Canada," constitute the remaining portion of Dr. G. M. Dawson's, 1885, collection, and are for the most part preserved in alcohol. This paper, illustrated by three full sized plates, was read before the Royal Society in May last, and has since been published in the current volume of its 'Transactions'; copies of it were distributed during December, 1893.

During part of April and in May, June, July, and from the 23rd of October until nearly the close of the year, he had in course of preparation, and has now completed a paper on Atlantic recent marine sponges, illustrated by three plates, which he proposes to read before the Royal Society in May next. This paper is an attempt to make as complete a catalogue as possible of the marine sponges of the Atlantic coast of Canada and of the River and Gulf of St. Lawrence, with descriptions of such as appear to be new. With few exceptions the specimens were collected by Sir William Dawson at various dates since 1845, and by Mr. J. F. Whiteaves in 1867, 1869 and 1871-73. About thirty-two species in all are represented, of which four are calcareous, and the remainder are siliceous.

In July a very large collection of sponges, made by Dr. W. H. Dall in Behring Sea and adjacent waters, was received from the Smithsonian Institution, Washington, D. C. These specimens, preserved in alcohol and contained in about one hundred and twenty-five jars, bottles and vials, were kindly sent to Mr. Lambe, for purposes of study in connection with the sponges already in the possession of this department from the Pacific coast and Behring Sea. It is his intention to

make a careful study of this collection, and to report on it with as little delay as possible, describing and illustrating such forms as may appear to be new.

During part of August and in September and October, he devoted himself to a preliminary microscopic examination of it.

On the 3rd of December, the collection was supplemented by one hundred and seventy-nine dried specimens of sponges and a number preserved in alcohol, in forty-five bottles, jars and vials; this includes not only the remainder of Mr. Dall's collection, but all the Alaskan sponges in the possession of the United States National Museum.

Mr. Lambe is greatly indebted to Professor Richard Rathbun, to Dr. Dall, and to the authorities of the United States National Museum at Washington for the opportunity thus afforded him of studying such an important collection of recent marine sponges.

During parts of March and July, he was engaged in assisting Mr. Whiteaves in ascertaining the septation of two ammonites from the Cretaceous rocks of the Queen Charlotte Islands, the characters of some fossils from the Guelph formation of Western Ontario, and of a large unio-like shell from the coal measures at the South Joggins, N.S. Drawings were prepared of these fossils illustrating papers by Mr. Whiteaves, mentioned in his report.

Between the 24th of August and the 29th of September, Mr. Lambe visited the World's Fair at Chicago, for the purpose of studying the exhibits bearing on his official work.

The number of official letters received by him during the past year was fifty-three, and the number written was thirty-four.

The following is a list of specimens collected by officers of the Survey during the past year:—

Dr. A. R. C. Selwyn:—

Nine specimens of fossiliferous shale holding ostracoda, from the boring at Calgary.

Fourteen specimens of Cretaceous (Pierre) fossils from the shore of Buffalo Lake, eighteen miles north of Moose Jaw, Section 17, Tp. 19, R. 26, Assiniboia.

Dr. G. M. Dawson:—

Mass of boulder clay, containing foraminifera and fragments of shells, collected at Middleton Island, Alaska, in 1892.

J. F. Whiteaves:—

About fifty specimens of fossils from the Guelph formation of Elora and Belwood, Ont.

Prof. Macoun :—

Large collection of the marine vertebrata and invertebrata of the coast of Vancouver Island, B. C.

About four hundred skins of birds and small mammals from Vancouver Island, B.C.

Dr. R. W. Ells :—

One hundred and fifty specimens of Trenton fossils from Clarence Creek, near Rockland Mills, county of Russell, Ont.

One hundred and thirty specimens of Post-Tertiary plants, marine fish and shells, from shore of Ottawa River, near Besserer's Grove and Green's Creek, Ontario.

J. B. Tyrrell :—

One hundred and seventy-eight fossils from Middle Rapids, and from two miles above Crooked Rapids, Athabasca River.

R. G. McConnell :—

About fifty specimens of fossil-plants from the Ominica and Finlay rivers, British Columbia.

Dr. H. M. Ami :—

About fifty specimens of Post-Tertiary fossils from Graham's clay-pits and brickyard, Ottawa East.

About fifty specimens of Trenton fossils from the new Rockland Quarries, in the county of Russell, Ont., and twenty from the Chazy and Potsdam formations of the same place.

A. E. Barlow :—

Between five hundred and six hundred specimens of Silurian fossils, from the Isle of Man, Lake Temiscaming, Que.

T. C. Weston :—

Fifty Carboniferous fossils from South Joggins, Nova Scotia.

Seventy-five specimens of graptolites in shales, Point Lévis, Que.

D. B. Dowling :—

Skin of three-year old Moose from Long-legged Lake, 1st of September, 1893, Keewatin.

J. McEvoy :—

Six specimens of obsidian arrow heads and one spear head, from the Shuswap District, B. C. ; also fifteen agate chippings from Indian graves, opposite Lytton, B.C.

R. Chalmers and W. J. Wilson :—

About fifty specimens of Leda Clay fossils from Prince Edward Island (north shore) ; Cape Egmont ; Campbellton, and Miminégash, and from Lancaster shore, St. John, N.B.

Twenty specimens of boulder clay fossils from a bank on the west side of St. John Harbour.

W. J. Wilson :—

Twelve fossils from the Permo-Carboniferous or Triassic rocks of Miminégash, P.E.I.

The additions to the palæontological, zoological and ethnological collections during the year, are as follows :—

By presentation:

The Smithsonian Institution :—

Nearly complete skeleton of the Great Auk (*Plautus impennis*) from Funk Island.

Miss A. Mowat, Regina, Assa. :—

Two fine specimens of *Scaphites nodosus* and three of *Baculites compressus*, from the Cretaceous of the Dirt Hills, south of Regina.

Rev. J. I. Keen, Masset, Q.C.I. :—

Specimen of a toad, from Masset.

A. J. Kingston, Ottawa :—

Four eggs of the Rose-breasted grosbeak (*Habia Ludoviciana*) from near Farrelton, P.Q.

Alexander McInnes, Springhill, N.S. :—

Forty-five fine slabs of fossil plants from the Coal Measures at Springhill, N.S.

Dr. C. F. Newcombe, Victoria, V.I. :—

Twenty-one specimens of Cretaceous fossils from the Comox River, V.I. ; twenty specimens of Post-Tertiary fossils from V.I., and some rare recent shells from the coast of British Columbia.

James Fletcher, Ottawa :—

Five marine sponges from Prince Edward Island, and one from Meach's Lake, P.Q.

Rev. G. W. Taylor, Victoria, V.I. :—

Thirteen specimens of two species of marine sponges from Victoria.

The Redpath Museum (per Sir William Dawson) :—

Specimen of the large spider crab (*Chinocætes opilio*) from the Gulf of St. Lawrence.

J. Townsend, Toronto, Ont. :—

Forty specimens of rare fossils from the Guelph formation at Belwood, Elora and Durham.

Colonel C. C. Grant, Hamilton, Ont. :—

Twenty-six specimens of fossils from the Niagara group near Hamilton.

By exchange :

From the Natural History Society of British Columbia :--

Four rare species of fossils from the Lower Cretaceous rocks of the Queen Charlotte Islands, and one from the Upper Cretaceous of Vancouver Island.

By purchase :

One skin each of the Parroquet, Crested and Least Auk, from the North Pacific, and one skin of Mandt's Guillemot, from the North Atlantic.

Eggs of the Red-headed Woodpecker, Blue Jay, Kill Deer Plover, and Wilson's Thrush, from Western Ontario.

NATURAL HISTORY.

On the work of the botanical branch during the year Professor Macoun reports as follows :—

"After the date of my last summary report, the continued absence of my assistant, Mr. Jas. M. Macoun, made it necessary that much of my time should be occupied with the ordinary routine work of the botanical branch which last winter included the preparation of certain exhibits for the Columbian Exhibition at Chicago. When time permitted progress was made with the preparation of the 'Catalogue of Canadian Birds' on which I have been working for several years whenever other duties allowed. In the course of the work it became apparent that our knowledge of the birds frequenting Vancouver Island and the neighbouring coast of the mainland was very incomplete, and it was decided to make a further examination of that region. Mr. William Spreadborough, who had been my field assistant for four years, was accordingly again engaged and directed to proceed to Vancouver Island and commence collecting and making observations on the birds and mammals of that island and its vicinity. This work was commenced by Mr. Spreadborough early in April, and on the 3rd of May Mr. Frank Wallbridge, of Belleville, and I, arrived in Victoria and at once commenced to collect.

"It may be stated here that in view of the increased museum space which it is hoped will become available some time in the near future, we have been for the past ten years steadily collecting material in all lines of natural history, so that when a locality is visited for the purpose of collecting botanical specimens we gather mammals, birds, reptiles, fish, shells, insects, etc., as well. In this way we now have in the museum quite a large and varied collection of material, and although much of it remains unclassified, it will be available when the proper time comes.

"The work on Vancouver Island this year was chiefly for the purpose of extending our knowledge of the birds breeding there, but besides this, large numbers of land plants and sea-weeds, in all over 1,400 species, were collected. About 150 species of birds were noted, and nearly 400 skins of birds and small mammals procured. Owing to the peculiarly wet and cold spring and early summer, the snow remained in the mountain woods so late that I decided to waste no time in the interior, but turned my attention to the sea which was always open.

"While at Comox, about 150 miles north of Victoria, during the month of June, rain fell steadily every day, and the prospects for a successful summer were very poor. A series of low tides occurred about this time, and although the rain did not cease we turned to the sea and made very large and valuable collections of marine invertebrates shells, and many species of crabs and other articulates, some of which were cleaned and dried and some preserved in alcohol. In July we visited Nanaimo in the hope that the snow in the mountain woods had disappeared, but on ascending Mount Benson, which is only 3,040 feet high, it was found that on July the 10th at 1,800 feet above the sea, violets that were abundant at Victoria, at the beginning of May were only then in flower. This same mountain had been ascended on the 8th of June, 1887, and all the snow at that time had melted and flowers were blooming on the summit. In the same year I ascended Mount Arrowsmith, and on the 17th of July, the mountain woods at an altitude of 5,400 feet were full of the same violet (*Viola sarmientosa*).

"During four days collecting at Nanaimo, 167 species of marine shells were secured, besides a large series of other marine animals. Similiar collections were made later at Victoria and Sooke. During the whole season I was ably assisted by Mr. William Spreadborough to whose indefatigable zeal, the large collections made are in great part due. He not only shot and skinned all the birds brought home, but under my instructions collected in all other branches of natural history, including botany. In August, after the work of the season was closed, he and Dr. Newcombe of Victoria, who is an adept in shells, made a trip to Clayoquot Sound, on the west coast of Vancouver Island, and around Stubbs Island collected and dredged 134 species of shells, many of which were of great interest and some peculiarly so.

"A few facts of economic importance were noted. Amongst these may be mentioned the presence of *Mya arenaria*, the common clam. Seven years ago this species was unknown on the coast of Vancouver Island, but had some years before this been planted on the California coast. Now it is extremely abundant on both sides of Vancouver

Island, and is quite common at Comox, 150 miles north of Victoria. The edible oyster was planted in Victoria Arm some years since, and Mr. Frank Wallbridge, while collecting at the mouth of Colquitz River, picked up a fine one, nearly four inches long.

"After leaving Vancouver Island in August, the adjacent mainland was visited, and for ten days collections were made in the vicinity of New Westminster and Burrard Inlet, similar to those that had been made on Vancouver Island.

"Since my return to Ottawa, on the 19th of September, I have been principally engaged in arranging and naming the cryptogams collected during the past season, while my assistant, Mr. James M. Macoun, is, when his other duties permit, prosecuting similar work in connection with the flowering plants collected by myself and others not only during this season but in 1892 as well. This work he will continue under my instructions, though the routine work of the branch occupies so much of his time that at the present rate of progress this work will be far from completion next spring.

In previous years I have been able to report large collections of plants having been received for our herbarium in exchange for those sent out, but during the past year owing to the absence of my assistant, who was engaged on work connected with the Behring Sea arbitration until the 15th of July, no specimens worth mentioning have been sent out, though several fine collections have been received from various public institutions, notably from Harvard University, from the California Academy of Science and from the Government botanist of Natal. For these as well as for many thousand others received during the past three years, exchange is still due from us. The accumulation of office work has been so great that until further assistance is given nothing more can be done in this line.

"During the year I have, as usual, examined and determined many collections of plants from all parts of Canada. The most important of these were from Miss Taylor, who made a large collection in the valley of the Mackenzie River; from Rev. A. Waghorne, who spent the past summer on the coast of Labrador; from Thomas Bean, who collected in the Rocky Mountains, and from Mr. W. Scott, who submitted to me for examination and determination nearly 1,000 species of plants collected along the line of the Canadian Pacific Railway between Winnipeg and the coast and on Vancouver Island. Mr. James M. Macoun brought with him from Behring Sea many specimens to add to those collected by him in 1891.

"Since the date of my last Summary Report, 346 letters of sufficient importance to copy were written in connection with the work of this branch and about the same number were received."

MAPS.

Maps in course of preparation and maps published during 1893:

	Sq. Miles.
North-west Territory, Athabasca and part of British Columbia (3 sheets) 20 x 30 in., to illustrate work of Mr. McConnell, 1889-90, and reaching from longitude 110° to 120°, and latitude 54° to 60°, ready for engraver, scale 8 miles = 1 inch. Index Map of the above, published 1893, scale 48 miles = 1 inch.	
North-west Territory, country lying between Athabasca River and Lake, and Reindeer Lake, reaching from west longitude 101° to 112°, and latitude 54° to 60°, in progress (Messrs. Tyrrell and Dowling), scale 8 miles = 1 inch. British Colum- bia, Kamloops sheet (Dr. Dawson), in progress, scale 4 miles = 1 inch.	6,400
British Columbia, Shuswap sheet (Dr. Dawson), in progress, scale 4 miles = 1 inch.	6,400
Mr. Bowman. { British Columbia, Placer Mines of Cunningham Creek, scale about 27½ chains = 1 inch.	34
{ British Columbia, Quartz Veins and Placer Diggings, Grouse Creek, scale about 25 chains = 1 inch.	14
{ British Columbia, Placer Mines of Antler Creek, scale about 26 chains = 1 inch.	38
{ British Columbia, Lightning Creek, scale 400 feet = 1 inch	17
{ British Columbia, Williams Creek, scale 10 chains = 1 inch	12
The above five mining plans were published in 1893.	
Rocky Mountains, region lying between Howse Pass and Athabasca Pass, Mr. McConnell, 1892-93, in progress, scale 8 miles = 1 inch.	48,600
North-eastern Manitoba, Lake Winnipeg, in progress, Mr. Dowling, scale 8 miles = 1 inch.	20,000
Northern Ontario north of Hunter's Island, sheet No. 6 (Messrs. Smith and McInnes, in progress, scale 4 miles = 1 inch.	3,456
Northern Ontario, sheet No. 9, Mr. McInnes, nearly ready for engraver, scale 4 miles = 1 inch.	3,456
Ontario, sheet No. 115, ready for draughtsman, scale 4 miles = 1 inch.	3,456
Ontario, sheet No. 118, Latitude 44° 50' to 45° 30', and longitude 77° 25' to 78° 54' (Mr. Adams), in progress, scale 4 miles = 1 inch.	3,456
Ontario, mining sketch map of the Kingston and Pembroke district, Mr. Ingall, in progress, scale 4 miles = 1 inch, area about.	1,700
Ontario, sheet No. 125, south of Sudbury sheet, Dr. Bell, in draughtsman's hands, scale 4 miles = 1 inch.	1,800
Ontario, sheet No. 129, west of Sudbury sheet, Dr. Bell, in progress, scale 4 miles = 1 inch.	3,456
Ontario, sheet No. 131, east of Sudbury sheet, Mr. A. E. Barlow, in progress scale 4 miles = 1 inch.	3,456

	Sq. Miles.
Ontario and Quebec, sheet No. 121, west of Eastern Townships Map, Dr. Ells, in progress, scale 4 miles = 1 inch....	3,456
N. E. Territory and Northern Quebec, exploratory survey by Mr. A. P. Low, from Lake Mistassini to the mouth of East Main River, in progress, scale 8 miles = 1 inch.	
Quebec, S. W. $\frac{1}{4}$ sheet, Eastern Townships Map, ready for engraver, scale 4 miles = 1 inch.....	4,500
Quebec, N. W. $\frac{1}{4}$ sheet, Eastern Townships Map, in draughtman's hands, scale 4 miles = 1 inch.....	4,500
Quebec and Lake St. John district, $2\frac{1}{4}$ sheets, in progress, Mr. Low, scale 4 miles = 1 inch.....	6,912
Quebec, $\frac{1}{4}$ sheet 18, S.E., Messrs. Bailey and McInnes, published in 1893, scale 4 miles = 1 inch.....	3,456
Quebec, $\frac{1}{4}$ sheet 18, N. E., Messrs. Bailey and McInnes, in progress, scale 4 miles = 1 inch.....	500
Quebec, Lièvre River and Templeton phosphate region, Ottawa county, 2 sheets, Mr. Ingall, with engraver, scale 40 chains = 1 inch.....	220
Mr. Chalmers. { New Brunswick, Surface Geology, $\frac{1}{4}$ sheet, 1 N. W., in progress, scale 4 miles = 1 inch.....	3,456
{ New Brunswick, Surface Geology, $\frac{1}{4}$ sheet, 2 S. W., in progress, scale 4 miles = 1 inch.....	3,456
{ New Brunswick, Surface Geology, $\frac{1}{4}$ sheet, S. E., ready for engraver, scale 4 miles = 1 inch.....	3,456
{ New Brunswick and Prince Edward Island, Surface Geology, $\frac{1}{4}$ sheet, 5 S.W. ready for engraver, scale 4 miles = 1 inch.....	1,500
{ New Brunswick and Nova Scotia, Surface Geology, $\frac{1}{4}$ sheet, 4 N. W., ready for engraver, scale 4 miles = 1 inch....	3,456
Nova Scotia, 16 sheets 18 x 12 inches (Messrs. Fletcher and Faribault), with engraver, scale 1 mile = 1 inch (sheets Nos. 25 to 40 inclusive), area about.....	3,000
Sheets, Nos. 25, 26, 27 and 28, of the above 16 sheets are ready for publication.	
Sheets 41 to 51, are nearly ready for engraver.	

LIBRARY.

Dr. Thorburn, the Librarian, reports that during the past year ended December 31st, 1893, there were sent out by him 12,891 copies of publications of the Survey, comprising reports, special reports and maps. Of these 8,253 were distributed in Canada, the remainder, 4,566, were sent to other countries for the use of the various leading scientific and literary institutions, and to persons engaged in scientific pursuits. In exchange for these the Survey received 2,393 publications, including reports, memoirs, proceedings, pamphlets, maps, &c.

There were 135 publications of various kinds purchased during the year for the Survey, and 39 periodicals were subscribed for.

Sales of publications by the Librarian during the year amounted to \$220.20.

There were 233 books bound during the year.

The number of letters and acknowledgments sent from the library was respectively 587 and 716. The number of letters received, including acknowledgments, was 617 and 1,869.

There are now in the library about 10,000 volumes and over 4,000 pamphlets, all being more or less of a technical character, and relating generally to geological, palaeontological, mineralogical, zoological and botanical subjects.

The library is open to the public for reference during office hours, but books are not allowed to be removed.

VISITORS.

The number of visitors to the Museum during 1893, has exceeded that of any previous year, namely, 21,000, and would probably have been some hundreds more had the Museum not been closed while the necessary repairs lately made, were in progress. In my last Summary Report I made some remarks on the desirability of opening the Museum on Sunday afternoons, and the educational advantages the doing so would confer on a large class of the community. In this connection I would now quote the following extract from the "News of the Week," Cardiff, Wales :—

"MUSEUM SUNDAY IN WALES.

"Next Sunday is to be Museum Sunday, and promises to be an even more successful one than last year, when it was first instituted by the Sunday Society. Upwards of forty of the clergymen of the Church of England and ministers of nonconformist bodies have promised to preach this year in support of the one object of the society, viz., the opening of museums, art galleries, libraries and gardens on Sundays. The Duke of Westminster, Lord Brassey and other friends will open their art galleries to members of the society during the afternoon."

The progress this movement is now evidently making in Britain, as shown by the above extract, is very encouraging to those who have for a number of years advocated the same movement in Canada.

STAFF, APPROPRIATION, EXPENDITURE AND CORRESPONDENCE.

The strength of the staff at present employed is 58, viz., professional, 37 ; ordinary, 21.

No changes have taken place in the permanent staff during the year 1893.

The funds available for the work of the department during the fiscal year ending 30th June, 1893, were :—

	Grant.	Expenditure.
	\$ cts.	\$ cts.
Civil list appropriation.....	49,502 50	
Geological Survey and Museum appropriation.....	60,000 00	
Civil list, salaries.....		48,477 50
Exploration and survey.....		29,365 07
Wages of temporary employees.....		18,429 85
Boring operations, Deloraine		2,690 72
Printing and lithography.....		7,601 48
Purchase of specimens.....		39 68
Purchase of books and instruments.....		1,321 03
Purchase of chemicals and laboratory apparatus.....		246 35
Stationery, mapping materials and Queen's Printer.....		1,320 99
Columbian Exhibition.....		360 30
Incidentals and other expenses.....		1,986 59
		111,839 56
Unpaid 30th June, 1893.....		330 58
		111,508 98
Less—Paid in 1892.....		7,107 73
		104,401 25
ADD—Advances to explorers for 1893-94.....		4,075 00
		108,476 25
Unexpended balance, civil list appropriation.....		1,025 00
do Geological Survey appropriation.....		1 25
	109,502 50	109,502 50

The correspondence of the department has, of late years, very largely increased ; in 1889 it is recorded as 7,100 letters sent and 5,860 received. This year, 1893, the numbers are 10,812 sent and 8,529 received, a total of 19,341.

I have the honour to be, sir,
Your obedient servant,

ALFRED R. C. SELWYN,
Deputy Head and Director.

GEOLOGICAL SURVEY OF CANADA
ALFRED R. C. SELWYN, C. M. G., LL. D., F. R. S., DIRECTOR

PRELIMINARY REPORT

ON THE

GEOLOGY OF A PORTION OF CENTRAL ONTARIO

SITUATED IN THE

COUNTIES OF VICTORIA, PETERBOROUGH AND HASTINGS

TOGETHER WITH THE RESULTS OF AN EXAMINATION OF

CERTAIN ORE DEPOSITS OCCURRING IN THE REGION

BY

FRANK D. ADAMS, M.A.P.Sc., Ph.D.



OTTAWA

**PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST
EXCELLENT MAJESTY**

1894



GEOLOGY OF A PORTION OF CENTRAL ONTARIO

SITUATED IN THE

COUNTIES OF VICTORIA, PETERBOROUGH AND HASTINGS.

The present report contains a brief summary of the results of a preliminary geological examination of that portion of Central Ontario comprised in sheet 118 of the Ontario series of geological maps on a scale of four miles to one inch, now in course of preparation, together with the results of an examination of certain mineral deposits to which attention has recently been attracted, and which lie to the south of the above mentioned sheet in the townships of Dalton, Digby, Lutterworth, Somerville and Galway. This preliminary examination was made in order to ascertain the general geological structure of the district in question, thus laying a basis for its detailed mapping and study which it is hoped will be commenced next summer.

Sheet number 118 embraces about 3,500 square miles and is situated to the north of Lake Ontario and to the south of the River Ottawa, in the counties of Victoria, Peterborough and Hastings. In order to describe its position more accurately it may be stated that the four corners of the sheet lie in the townships of Digby, Finlayson, Hagarty and Grimsthorpe, respectively. The district was, geologically speaking, almost a *terra incognita*, the only geological information extant concerning it, being a few notes on the occurrence of crystalline limestone and gneiss at various points, made by Mr. Alex. Murray in connection with two traverses which he carried through this district as far back as 1853, together with one or two general references in scattered papers by other authors.

Area described.

Geologically speaking a *terra incognita*.

The geology of the district comprised in sheet 118 may be briefly summarized as follows: The district is a hilly one, which, leaving out of consideration the superficial or drift deposits, is occupied exclusively by the very ancient crystalline rocks of the Laurentian System with the possible exception of the south-east corner of the area in Chandos, Wollaston, Limerick, Cashel, Mayo and the adjacent townships, which is underlaid in part by the Hastings series of Mr. Vennor, by him and by Mr. Macfarlane in 1869, considered to, in some respects, resemble the Huronian,* and a small outlier of Silurian limestone which was discovered in the township of Lynedoch, just beyond the eastern limit

* Report of Progress, Geol. Survey of Can., 1869, pp. 5-6.

of the sheet, but which is believed to extend over the boundary of the sheet into the township of Raglan.

In the southern and eastern portions of the sheet the Laurentian contains an abundance of crystalline limestone and has all the characters of the Grenville series of Sir William Logan, in which series as is well known nearly all the mineral deposits of economic value occurring in the Laurentian in Quebec and Eastern Ontario are found. In the north-western portion of the area on the other hand our explorations have so far failed to discover any crystalline limestone, the country being apparently occupied by gneiss alone. As townships in which this crystalline limestone is especially abundant, Lutterworth, Minden, Snowden, Dysart, Glamorgan, Monmouth, Cardiff and Brudenell may be mentioned, as well as the township of Galway lying to the south of the area embraced in sheet 118.

Occurrence of
the Grenville
series.

The discovery of so large an area of the Grenville series in this district is most encouraging, as indicating the probable occurrence in it of large and valuable mineral deposits.

The relation of the Grenville series, in this district, to the rest of the Laurentian which is free from limestone, has not as yet been definitely determined, although the limestones and their associated gneiss seem in certain cases to partially inclose areas which contain no limestone. Another noteworthy fact is that throughout the area occupied by these Laurentian rocks, the dip is uniformly in an easterly direction usually at moderate angles. Only at one or two points have westerly dips been observed and these are quite local.

Hastings
series.

The relation of the Hastings series, occurring in the south-east corner of the sheet, to the Laurentian above described, is also as yet uncertain. Like the relations of the subdivisions of the Laurentian to one another this can be determined only as the area is mapped in detail. One of the most marked characters of the Hastings series in this district is the great development in it of pyroxenic and hornblendic rocks, many of which are without doubt of eruptive origin, and which serve to obscure the relation which it bears to the Grenville series. The rocks of the two series as seen in this area are otherwise not very unlike petrographically, but it must be noted that the portion of the Hastings series included in this sheet was supposed by Mr. Vennor to represent only its lower horizons, while the upper portions containing the conglomerates, shales, &c., which are well developed further south, are here absent. In this south-east corner there are also several large intrusive masses of granite, probably of the same age as those which occur immediately to the south. These occurrences augur well for the discovery of gold in this district; since, as Mr. Coste has shown, the gold deposits

of the Hastings district are all intimately associated with these southern granites.

In addition to these great intrusions of pyroxenic rocks and of granite, a very extensive and most remarkable mass of nepheline syenite was discovered in the townships of Faraday and Dungannon. The exact distribution of this has not as yet been worked out, but it has been traced for a distance of over seven miles in an approximately east and west direction, from the York River, about the middle of the township of Dungannon, across the Hastings road to a point some distance west of the village of Bancroft, in the township of Faraday. This is a rare rock, found in but few places in the world and never before discovered in our Laurentian System. The nepheline is very abundant, forming in many places an almost pure nepheline rock. The mass is flanked on the south along a considerable part of its course by crystalline limestone and it is also intimately associated with a fine grained reddish rock resembling aplite. It is of a prevailing gray colour and often has a distinct foliation coinciding with that of the associated rocks. The rock in places becomes exceedingly coarse in grain, individuals of nepheline as much as two feet and a half in diameter having been observed by the York River on Range XI. of Dungannon, near the side line of lots 12 and 13. Although this mineral is one which has no great economic value, masses such as those referred to would sell for considerable prices as mineral specimens. In this nepheline syenite, in the form of veins and irregular masses, the beautiful blue mineral sodalite was found in a number of places. A good specimen of it from lot 29, range XIII. of Dungannon, is on exhibition in the museum of the Geological Survey in Ottawa. On lot 25, range XIV. of Dungannon, however, on the property of Mr. John Bowers, these veins and masses attain a very considerable size and are somewhat numerous. Some of these, consisting of bright blue sodalite, ten by ten by four inches in size were observed, and probably larger specimens could be obtained by blasting. This mineral could be employed as a substitute for *Lapis Lazuli* in the manufacture of various ornamental objects, and such large masses would also have a very considerable value as mineral specimens. A specimen of it which was cut and polished for me by Mr. R. Forsyth of Montreal, shows that the mineral would present a handsome appearance when so prepared. Being a surface specimen however, it was found to be traversed by minute cracks which caused it to crumble somewhat readily; these would however in all probability not occur in the unweathered specimens obtained some distance below the surface. The occurrence of certain other interesting minerals has also been noted in this rock and a special paper on it is being prepared.

Large area of
nepheline
syenite.

Silurian
outlier.

The outlier of Silurian limestone in the township of Lynedoch is of much interest as proving, what was before conjectured, namely, that the flat Silurian limestones of the plains of central Canada were once continuous over the rough and hilly Laurentian country to the north, at least as far back as the Pembroke basin, where an isolated area of these rocks has long been known to exist.

Valuable
minerals.

Deposits of iron ore, mica, apatite and other valuable minerals were found in the district embraced in the sheet, but as a detailed examination of these and report upon them will be made later on as the mapping of the area progresses, they will not here be further referred to.

Laurentian
area to south
of sheet 118.

To the south of the area embraced in sheet 118, there is a narrow strip of Laurentian country lying between the southern limit of 118 and the flat Silurian limestones above mentioned. This strip is underlaid by gneisses which in many places are associated with crystalline limestones and forms a southerly continuation of the district above described as occupying sheet 118. In the western part of this strip in the county of Victoria the existence of certain mineral deposits supposed to be of economic importance having been reported, I was instructed to examine these with a view to determine their character and value. As this district lies outside of the sheet assigned to me for mapping, it will not be included in any subsequent report and I have therefore considered it best to state the results of my examination of these deposits in this place. The assays of the ores I collected have in all cases been made in the laboratory of the Geological Survey under Mr. G. C. Hoffmann, the chemist to the Survey, and may therefore be relied upon as of undoubted accuracy. The consideration of these deposits may be best taken up under the heads of the several townships in which they occur.

Dalton.—This township is underlaid by reddish orthoclase gneiss with dark micaceous or hornblendic bands; it is excellently exposed over a large part of the township, but no crystalline limestone was seen nor could the existence of any be ascertained by inquiry. Cutting through the gneiss there are a great number of coarse grained granite veins, composed of quartz and felspar, with black mica or magnetic iron ore or sometimes both. The veins are in some places very abundant and of considerable size. They vary somewhat in size of grain and when very coarsely crystalline the black mica or magnetite is often in masses of considerable size. The former is not of a colour or size to be of economic importance, but in a number of places the latter has attracted considerable attention. From some of these veins excellent hand specimens of iron ore can occasionally be obtained, but they do not contain ore in anything like sufficient quantity to be of economic

value, nor can they be considered as indicating the presence of heavier deposits in this vicinity. Small quantities of iron ore were observed in perhaps a hundred different places in the township; but always occurring in this way. As a locality where these masses of iron ore are larger than usual, attaining a diameter of several inches, lot 26 of range XII. may be cited.

On lot 25 of the same range, gold was reported to have been discovered. On visiting this locality the opening was found to be situated on one of the granite veins above mentioned. The vein was a foot wide and was composed of quartz, felspar and black mica, with a little magnetite, chlorite, iron pyrites and allanite. It cuts orthoclase gneiss with dark hornblende bands, one of these latter forming the foot wall in the opening. A series of specimens were taken representing the average of the vein as exposed in the opening. These were assayed in the laboratory of the Survey, but were found to contain neither gold nor silver. The small yellow grains of iron pyrite may have been mistaken for gold. The occurrence of the somewhat rare mineral allanite in this vein, although in small quantity, is of interest. This mineral was found last summer at three places in the district examined, and was formerly known to occur in but three localities in the Dominion. It is black in colour, possesses a lustre like pitch, and contains several rare elements. Allanite.

Digby.—The western portion of this township may be considered geologically as an eastward extension of the township of Dalton, while in the eastern portion some crystalline limestone appears, causing it in this way rather to resemble the adjacent part of the township of Lutterworth. Granite veins also occur here in great abundance, holding small quantities of iron ore as in Dalton. A number of localities from which iron ore was reported were visited. Among these may be mentioned one about half a mile south of Smudge Lake, where a granite vein eight feet wide was found, in which magnetic iron ore occurs sparingly in strings and patches, the largest of which measures only seven by two inches. Small quantities of iron ore were also found on lot 15 of range VIII. scattered through the gneiss. This ore contains titanitic acid. Township of Digby.

On lot 16 of VII. a small string or vein of molybdenite was observed in the gneiss. It was five inches long and one inch and a half wide, and coincided in direction with the strike of the gneiss. It was pure and of good quality, and although this vein is not sufficiently large to be worked with profit, yet its occurrence in this district indicates that larger deposits may be discovered on careful search for them. Molybdenite when pure is worth about fifty cents a pound. Molybdenit

Township of
Lutterworth.

Lutterworth.—In this township there is an abundance of excellent crystalline limestone, especially in that part of it which lies to the east of Gull Lake. Much of this is very pure and constitutes a veritable marble, as on lots 19 of ranges IV. and V., and on lot 20 of V., while elsewhere it contains grains of hornblende, mica, serpentine and other minerals scattered through it. This limestone would yield excellent lime, and could also be employed for building purposes if sufficiently accessible. It is, however, rather coarse grained for very fine work or for statuary.

There is a local tradition that silver was formerly mined at Miner's Bay on the east shore of Gull Lake. No workings are known to exist, however, and no ore is ever known to have been discovered in the vicinity. A little molybdenite in flakes and crystals was found in the gneiss at this locality. This may, on account of its silvery appearance, have been mistaken for an ore of silver.

Molybdenite disseminated through crystalline limestone also occurs on lot 23 of range V.

Molybdenite
and graphite.

Graphite was observed in small quantities in the gneiss and limestone at several localities. I am informed that it occurs more abundantly on lot 15 of range IV.

A deposit of iron ore on lot 5 in the northern part of range V. and the southern part of range VI. of this township, was at one time worked quite extensively, several hundred tons of ore were extracted and shipped, but work was discontinued seven or eight years ago. Two large openings and several small holes have been excavated in the deposit, but are now for the most part filled with water. The country rock is a reddish gneiss interstratified with many small amphibolite bands as well as with a small band of crystalline limestone.

Iron ore.

The ore body conforms to the strike of the gneiss, but is irregular in width. In one of the main openings it is thirty-five feet wide. This, however, is not all iron ore, since—as is the case with so many of the iron ore deposits in these Laurentian rocks—the ore itself is mixed with a large quantity of various black ferruginous silicates such as hornblende, pyroxene and garnet. The ore body is also cut by many reticulating veins holding quartz, calcite, orthoclase, pyroxene, scapolite, allanite and other minerals. The ore is almost free from pyrite and other sulphides, and specimens selected by me and examined in the laboratory of the Survey were found to be free from titanium, but as above stated, it contains a large proportion of various silicates amounting in the case of a sample examined by Professor Chapman to 23.80 per cent, while other samples would give considerably higher percentages. The presence of these silicates, however, while lowering the percentage

of iron, produces an ore which is easily smelted and which closely resembles the so-called self-fluxing ores of Sweden. The following analysis of the average ore from this "Paxton Mine" is given by Mr. Hamilton Merritt:

Oxide of iron.....	67.77 (Metallic iron = 48.64).
Silica.....	19.30
Alumina.....	6.24
Lime.....	3.81
Magnesia.....	3.38
Sulphur.....	0.03
Phosphorus.....	None.
Titanic acid.....	0.15

100.68

Galway (with the adjacent part of Somerville).—This township is almost entirely occupied by crystalline limestone and the peculiar gneisses usually associated with it. As a field for the discovery of mineral deposits it is one of the most promising townships in the whole area. I had been especially directed to examine certain deposits, supposed to contain nickel, in this district, and accordingly devoted much attention to these, visiting almost every deposit in the township supposed to contain this metal.

Townships of
Galway and
Somerville.

These deposits, consisting as they do of pyrrhotite with some pyrite, are often compared to the Sudbury nickel deposits; an examination of the district, however, shows that the geological relations of the two sets of deposits are quite different. The ores in the Sudbury district occur in great diorite intrusions near their contact with granite or with the stratified rocks of the district, which are of Huronian age, while those of the townships of Galway and Somerville occur as impregnations in bands of gneiss belonging to the Grenville series. The two sets of deposits are quite different therefore in mode of occurrence and probably in age, and what has been proved to be true of the former cannot by any means be regarded as indicating what may be expected in the case of the latter. This conclusion, reached from a geological examination of the two areas, is borne out by the results of Mr. Hoffmann's assays.

Everywhere throughout the Laurentian System, as far as explorations have been carried, where bands of crystalline limestone occur these are accompanied by, or associated with, bands of a very rusty weathering gneiss. The gneiss on a fresh fracture is light in colour, often nearly white, the property of weathering with a rusty surface being due in most cases to the dissemination through it in larger or smaller amount of sulphides of iron in the form of the yellow minerals

Pyrrhotite
and pyrite in
gneiss.

Gossan hold-
ing copperas.

known as pyrrhotite and pyrite, which on exposure to the weather decompose into hydrated oxide of iron or iron rust. These bands of rusty weathering gneiss are especially large and well developed in the township of Galway and it is in them that openings have been made in a number of places in the expectation of finding nickel or gold and silver. The quantity of the sulphides above mentioned in some of the bands is very large. At several points in the decomposed rusty material forming the "gossan" surface of the bands, pockets of pale green hydrous sulphate of iron or copperas, locally termed "salt," and known to mineralogists as melanterite, often containing several pounds weight of this material, were found. It is also derived from the decomposition of these sulphides of iron, and when obtained in sufficient quantity it is employed in dyeing and tanning as well as in the manufacture of ink and Prussian blue. The following are some of the localities where these mineral deposits were examined:—

Somerville, Lot 1, Range XI.—Oh this lot which abuts on the township of Galway a very rusty weathering band of gneiss crosses the Bobcaygeon road. It is about 150 yards wide, striking about N. 10° W. with an east dip and is flanked on either side by crystalline limestone. Two shallow pits have been opened in it, exposing the rock for a few feet below the surface. This is seen to contain pyrite disseminated through it in strings and in some places to be rich in garnet. The amount of pyrite contained in the rock must be very considerable and the strings in which it occurs are often of large size. The rock weathers to a loose porous very rusty mass containing in places, in pockets of considerable size, the hydrated sulphate of iron above referred to as a decomposition product of the pyrite. This rock was stated to have been assayed and found to contain a large amount of gold with some nickel. It had also as usual been examined with satisfactory results by a mineral rod man. A number of samples were accordingly taken, those containing as much pyrite as possible being selected, since these would contain the maximum amount of the metals in question. These were assayed in the laboratory of the Survey and found to contain:—

Gold.....	None.
Silver.....	None.
Nickel.....	Faint trace.

Galway, Lot 1, Range X.—Here a hole fourteen feet deep has been sunk in a quartz vein in gneiss. The vein was about two feet thick at the surface and contains some calcite and pyrite with a small amount of pyrrhotite. I was informed by the owner of the property that the ore had been assayed by Professor Chapman of Toronto, who found that

it contained nothing of value, but that an assayer in Oregon had returned it as containing 30 oz. of gold to the ton in addition to silver, nickel and copper. Several specimens were accordingly selected containing more than an average amount of the metallic constituents and these were assayed in the laboratory of the Survey. Mr. Hoffmann reports that they contain :—

Gold	None.
Silver	None.

The proportion of the metallic constituents in the vein was on an average so small that it was not considered worth while to incur the trouble and expense of assaying it for nickel.

Galway, Lot 16, Range XV. (north end).—Here a pit eight feet deep has been sunk in a thick band of very rusty weathering gneiss which appears to strike a little to the east of north and dips to the east at an angle of about 30°. As usual this gneiss is associated with crystalline limestone which occupies the greater part of the lot. In this gneiss there are some bands containing a good deal of garnet as well as some composed of quartzite. All contain both pyrite and pyrrhotite, often in large amount. Masses of these sulphides, especially of the latter as much as seven by twelve inches in size, are seen on the walls of the pit. As the band is so large and the amount of the sulphides present so great, the deposit is well worthy of a thorough exploratory examination. In order to ascertain its probable value a large number of fragments were broken from various places on the walls and bottom of the pit, selected so as to represent as nearly as possible an average of the whole as here exposed. These contained a large amount of both pyrite and pyrrhotite and were assayed in the laboratory of the Survey with the following result :—

Deposits of
pyrrhotite
and pyrite in
gneiss.

Gold	None.
Silver	None.
Nickel	Faint trace.

Galway, Lot 16, Range XIV. (south end).—A pit of about the same depth as in the case of the last deposit has here been sunk on the line of contact between the crystalline limestone and the rusty weathering gneiss. The latter, which where perfectly fresh is light grayish in colour, contains a considerable amount of pyrrhotite, with some pyrite, in strings often several inches wide. If these minerals contained any valuable metal in considerable amount, this deposit would also be worthy of a thorough exploratory examination. Some of the pure pyrrhotite was accordingly selected and was assayed in the laboratory of the Survey. Mr. Hoffmann reports it to contain :—

Gold	None.
Silver	None.
Nickel (with some cobalt)	·05 p.c.

This percentage of nickel is of course far too small to give the mineral any value as an ore.

Galway, Lot 18, Range IV. ("Reynold's Mine.")—This deposit was examined by my assistant, Mr. A. A. Cole, B.A., who reports that a pit forty by eight and twenty-three feet deep has been sunk on a bed or vein of white quartz, from four to six feet thick, which is interstratified with fine grained dioritic gneiss. Pyrrhotite mixed with pyrite occurs in bands in the quartz. The largest of these appearing at the surface is four inches wide, but expands in places so as to form pockets, while elsewhere the metallic minerals occur finely disseminated through the quartz. A specimen of the pyrite and pyrrhotite, nearly free from gangue, was assayed in the laboratory of the Survey, with the following results:—

Gold.....	None.
Silver.....	None.
Nickel (with some cobalt).....	10 p.c.

Here again the nickel is entirely too low for profitable working.

Openings have also been made in search of nickel at the following localities:—

Galway, Lot 11, Range XVIII.—An opening has been made at the contact of rusty gneiss and crystalline limestone; both hold pyrrhotite in small amount in the form of little grains and strings.

Galway, Lot 11, Range IV.—Highly quartzose gneiss, often garnetiferous, containing small quantities of disseminated pyrrhotite.

Galway, Lot 15, Range IV.—Two small openings in rusty weathering gneiss overlaid by crystalline limestone. A little pyrite and pyrrhotite seen in places.

Galway, Lot 7, Range A.—Two openings, one in crystalline limestone, carrying a small quantity of pyrrhotite, and the other in a fine grained gneiss, carrying some pyrite and a little pyrrhotite.

In view of the absence of gold and silver and the very low percentage of nickel present in the heavily impregnated deposits, it has not been considered necessary to assay specimens from these last four localities, where the deposits are similar in character, but poorer in metallic minerals.

The deposits
unlike those
at Sudbury.

The examination of these deposits therefore goes to show, that although in some cases the pyrrhotite and pyrite occur in sufficient abundance to enable the deposits to be profitably worked if these minerals were rich in nickel, that, unfortunately, unlike the pyrrhotite of the Sudbury district, they carry nickel only in very small amount. In this connection it is extremely interesting to compare the pyrrhotite depo-

sits of Norway with those of Canada. In Norway, as is well known, there are very large deposits of this mineral, associated with pyrite, which are rich in nickel and have for many years been extensively worked for this metal. These occur intimately associated with great masses of an intrusive rock belonging to the gabbro family, through which the pyrrhotite occurs disseminated, the workable deposits being apparently parts of the gabbro mass especially rich in this constituent.

These Norwegian deposits are the equivalents of the deposits of the Sudbury district in Canada, where similar great pyrrhotite deposits, rich in nickel, are related in precisely the same way to great intrusive masses of a rock closely allied to the Norwegian gabbro and which in Canada is called diorite.

In Canada, as in Norway, the pyrrhotite deposits are probably a Canadian and peculiar product of the differentiation of the gabbro or diorite magma. Norwegian deposits compared.

In Norway there are also bands of gneiss, mica schist, quartzite and other similar rocks heavily impregnated with pyrrhotite and other sulphides. These are called "Fahlbands" and closely resemble those just described from Galway and Somerville. In these the pyrrhotite, although often present in large quantity, is so poor in nickel that it is valueless. In both countries the geological formations and the mode of occurrence of the two classes of deposits are the same and in each case the ores associated with the diorite or gabbro rock are rich in nickel, while those impregnating the gneiss so far as they have been examined, contain hardly any. I know of no case where the value of geological study as applied to ore deposits is better illustrated or where the knowledge obtained from the study of the ore deposits of one land is seen to be of such practical value when applied to those of another land where the geological conditions are the same.

Concerning these Norwegian Fahlbands, Prof. Vogt, of Christiana, in a recent paper* writes as follows, and it will be observed that his remarks might be applied almost word for word to the Canadian deposits:

"The Fahlbands are bedded or apparently bedded deposits consisting of pyritous impregnations in certain schists, as for example mica schist, hornblende schist, quartz schist, garnetiferous gneiss, hornblende gneiss, &c., and occurring without any connection with gabbro rocks. The schist containing the ore, which varies in amount from place to

*"Zeitschrift für praktische Geologie," Jan. 1893, p. 130. This paper, which is continued in the April and July numbers of the same publication, contains an excellent description of the Norwegian deposits. A short paper entitled "The Nickel Deposits of Scandinavia" by the same author, illustrated by cuts, showing the mode of occurrence of the nickel ore, appeared in the "Canadian Record of Science" for April, 1892. A somewhat extended resumé of Prof. Vogt's work is also given by the present writer in a paper entitled "On the Igneous Origin of certain Ore Deposits," in the "Canadian Mining Review," February, 1894.

place, can often, although quite thin, be traced for miles. The geological difference between these and the nickel deposits associated with the gabbro is evident. . . . It must also be emphasized that the pyrrhotite and pyrite of these Fahlbands are invariably characterized by a very small content of nickel and cobalt. Hundreds upon hundreds of analyses of these minerals from the Fahlbands have been made and a very small amount of nickel and cobalt ranging from .1 to .5 per cent has always been found. So far as I am aware no pyrrhotite is known for these Norwegian Fahlbands which contains 1 per cent of these metals."

Iron ore.

Deposits of iron ore are also known to occur in Galway. One of these situated near Swamp Lake on lot 23 of range XII. was visited. The country rock is a reddish gneiss, interstratified with a dark hornblende gneiss, which latter rock in places, for a width of several feet, contains grains and strings of red garnet, yellowish green epidote and magnetic iron ore. Although good specimens of magnetite can be obtained, this mineral is too scattered and not present in sufficient amount at this point to make an ore of much value. If, however, the deposit were traced out on its strike the magnetite might somewhere be found to come in in larger amount. A good specimen of iron ore from this lot was analysed by Professor Chapman and found to contain :

Metallic iron	62.60 p.c.
Oxide of manganese.....	1.27 "
Phosphorus.....	0.01 "
Siliceous rock matter.....	12.18 "

Another deposit occurs on lot 27 of range XIV. of Galway. A sample from this was, some years ago, examined by Professor Chapman and found to contain :

Metallic iron.....	62.87 p.c.
Siliceous rock matter.....	13.27 "

Lead ore.

A deposit of lead ore has been opened on lot 20, range A. of Galway. A shaft with lateral drifts has been sunk to a depth of about 100 feet, but this at the time of my visit was filled with water. Near it, however, a short tunnel is driven in the vein from a hill side. In this the vein is seen to vary somewhat in width, but to be fourteen inches wide at its widest part. The vein stone is barite with some calcite, carrying in the tunnel a few grains of iron pyrite, zinc blende and galena. A considerable amount of galena has been taken from the shaft where the vein is said to be somewhat wider and contains the galena in pockets. I am informed that about thirty kegs of galena have been shipped. A number of specimens of the galena and barite as well as a few of calcite and zinc blende now lie about the mouth of

the shaft. As the value of the galena would depend largely on its content of silver, which metal is almost invariably found in galena, but is present in very variable quantity in the galenas from different localities, I selected some of the pure galena from the shaft and handed it to Mr. Hoffmann for examination. It was, however, found to contain neither gold nor silver. Its value will therefore depend on the high percentage of lead which it contains. The vein cuts gneiss which is interstratified with crystalline limestone. A vein similar in character to the one just described and which is probably a continuation of it, is seen on lot 1 of range VII. of the adjacent township of Somerville. It is vertical in position ; cuts a highly micaceous gneiss and is exposed in two shallow pits. It is from five to six inches wide and is composed of barite with some calcite, carrying in places a little galena.

GEOLOGICAL SURVEY OF CANADA
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR

PRELIMINARY REPORT

ON

GEOLOGICAL INVESTIGATIONS

IN

SOUTH-WESTERN NOVA SCOTIA

BY

L. W. BAILEY, M.A., Ph.D., F.R.S.C.



OTTAWA

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MOST EXCELLENT MAJESTY

1895



ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S.,
Director of the Geological Survey of Canada.

SIR,—I have the honour to submit herewith a preliminary report of geological explorations in south-western Nova Scotia.

These explorations were begun in the year 1890, and were continued during the following seasons to and including the summer of 1893. At the close of the last named year a detailed report upon the geology of Queen's and Shelburne counties was submitted for your approval, and was accepted for publication. A large amount of material was at the same time in hand relative to the geology of Yarmouth and Digby counties, and the western part of Annapolis county; but several important questions having arisen in this connection which seemed to require further investigation, a detailed report relating thereto was reserved until these doubtful points could be determined. In the meantime, and pending the publication of the report already submitted, it has been thought desirable to issue the present preliminary report in which the more general results in all four of the counties first named are summarized, together with some remarks upon the economic aspects of the districts to which they refer.

In connection with the first of the reports referred to above, maps of the several south-western counties of Nova Scotia, reduced by eidograph from Church's maps of the same counties, but modified through the results of our own explorations, and having added thereto the chief geological features of the region, were submitted. A difficulty, however, arising chiefly from discordant boundaries, having been met with in endeavouring to effect the direct combination of the several maps thus independently constructed, it has been thought best, in connection with this preliminary report, to employ instead a compilation from some of the more general maps of Nova Scotia, prepared by the same author, and to represent thereon, as far as possible, the geological data now in possession. A map so constructed is accordingly herewith submitted.

In carrying out the explorations embodied in these several reports and maps, I was in the year 1891 accompanied and assisted by Mr. L. Lee Street, and during the summers of 1892 and 1893 by Mr. W. H. Prest. While under obligations to both gentlemen for services cheerfully rendered, I am especially so to Mr. Prest for the zeal and endurance manifested by him, more particularly in the working out of the details of the several granitic areas and of the formations adjoining them, an undertaking often of a most difficult and arduous character. Mr. Prest's intimate acquaintance with the varying aspects of the Cambrian system throughout Nova Scotia, as well as with the practical working of many of the more important gold districts, also gave to his assistance a greatly increased value.

I have the honour to be, sir,
Your obedient servant,

L. W. BAILEY.

PRELIMINARY REPORT
ON
GEOLOGICAL INVESTIGATIONS
IN
SOUTH-WESTERN NOVA SCOTIA

BY
L. W. BAILEY, M.A., PH.D., F.R.S.C.

It is now over twenty years since the publication of anything directly relating to the geology of south-western Nova Scotia. In the year 1871 Dr. A. R. C. Selwyn, Director of the Geological Survey, in connection with an interesting report upon the gold formation of Quebec and Nova Scotia, as compared with similar formations in Australia, gave a brief summary of the features of the rocks seen in the coast section from St. Mary's Bay to Tusket; but with this exception the only references to this region, of a geological nature, are those contained in the Acadian Geology of Sir J. Wm. Dawson and its several supplements, and these too are extremely limited. The more systematic explorations since undertaken have embraced all parts of the region referred to, and in some respects have greatly modified the views previously entertained. In the remarks which follow only the general results of these explorations are given, the details being left to appear in subsequent reports. Earlier investigations.

The formations to be considered embrace :

Granite.

The Cambrian system.

The Devonian system.

Triassic sandstone and associated traps.

GRANITE.

Nature of
boundaries

An important but at the same time very difficult part of the work upon which we have been engaged, has been that of the exact delineation of the granite areas in the counties of Queen's, Shelburne, Yarmouth and Digby. This difficulty has arisen partly from the fact that the region thus occupied is, except upon the coast, wholly unsettled, untraversed by roads or navigable streams, and, owing to its boulder-strewn surface, of so rough a character that its penetration to any considerable distance is a most arduous undertaking; and still more from the fact that the boundaries themselves are naturally ill defined and largely concealed by a covering of drift. Under these circumstances it is not to be wondered at that the outlines of the granite areas, as now defined, should differ widely from those assigned to them by earlier observers. In the first place it may be observed that the number of distinct granite areas is considerably larger than has heretofore been represented, and that these include tracts or belts of all dimensions from a width of ten or fifteen miles down to a few yards. While, also, in the case of the great central belt, it has been usual to represent this as of nearly uniform breadth and regular outlines, sweeping around continuously, and in the form of a regular crescentic curve, from Halifax through Annapolis and northern Lunenburg to Digby, Yarmouth and Shelburne counties, the actual facts are widely different. Its outlines are in reality extremely irregular, exhibiting at various points long projecting tongues, and at others becoming so far narrowed that the actual continuity of the belt is at one point extremely doubtful.

Including the main belt, traversing the axis of the peninsula, the several more considerable areas of granite now clearly recognized, in south-western Nova Scotia, may be stated as follows:—

South Mountain
granites

1. South Mountains. These are the direct continuation of the hills so-called which occupy the larger part of the county of Annapolis, connecting eastwardly with the similar rocks of King's county, and westwardly with the granites of eastern Digby and Yarmouth counties. The width of the belt as measured along the post-road connecting Annapolis and Liverpool is twenty miles, and this width is not very greatly reduced on the confines of Digby and Yarmouth counties. There is, however, reason to believe that at least one belt of schistose rocks lies along the axis of the elevation and tends to divide it into two partially separated areas. It also sends two diverging spurs into Queen's county, one just east of and partly including Tupper Lake, the other holding a similar relation to Tobieatic Lake. Upon the

north the granite of this tract reaches quite to the shore of Annapolis Basin, and thus separates the basin of fossiliferous (Devonian) rocks of Nictau from those of similar character at Clementsport and Bear River, while in Digby county a second northward extension of the granite area similarly separates the fossiliferous Bear River beds from others now known to occur about the headwaters of the Sissiboo River.

2. Blue Mountains. The western limit of the granites in Digby county is in the form of a tolerably even curve, convex to the west-ward and extending from Mistake River, one of the tributaries of the Sissiboo, to the Yarmouth county line, a few miles north of Rockingham, but after a marked eastward bend at this point, turns again abruptly to the westward to form a long narrow spur reaching almost to the east branch of the Tusket. It is this spur which constitutes the Blue Mountains proper, and serves to divide the Cambrian basin of the Tusket from that about the sources of the Clyde. The width of the granite from the headwaters of the Clyde to Bear Lake Brook, a tributary of the Tusket, is about five miles and a half. All this tract, and for miles to the north and south, is one vast blue-berry barren, with occasional small patches of woods. It is intersected with streams and dotted correctly with lakes, of which neither the number, position or shape is set down on any existing maps.

Granites of
Digby county

3. Tusket Wedge. The southern half of the peninsula known as Tusket Wedge is composed of granite, as are the Tusket Islands lying a few miles to the south. The area now above the sea-level is a small one, but of interest as being in the same line with the Blue Mountain range, and with the latter apparently marking the course of an anticlinal, elsewhere occupied by Cambrian quartzites.

Tusket
Wedge.

4. The Barrington area. This area upon the coast is large, embracing all the shore from the mouth of Pubnico Harbour to the town of Barrington, and along the post-road connecting Yarmouth with Barrington has a breadth of about eight miles; but to the north-eastward of this exhibits a marked diminution, and apparently terminates in wedge-like form along the county-line of Shelburne, not far from where this is crossed by Bloody Creek, a western tributary of the Clyde. It is barely possible that it may connect with a southward spur of the Blue Mountain range, but if so the connection must be very slight and is now hidden by drift.

Barrington.

5. Shelburne area. This area is a comparatively small one. It occupies both sides of Shelburne Harbour in its upper half and extends up the Roseway River for about five miles. It is apparently disconnected with any other granite tracts, though pointing in the direction

Shelburne.

of a considerable area of such rock which, in the north-eastern corner of Shelburne county, extends south-westerly from the main granite belt (No. 1) just west of Tobeatic Lake in Queen's county.

Port Mouton. 6. Port Mouton area. The last considerable granite area within the region here described is found along the western side of Port Mouton Harbour, thence stretching westwardly in a narrowing tongue-like belt past the head of Port l'Hébert. Indications of an eastward extension of the same granite belt are found in numerous detached areas along the coast, either side of the mouth of Liverpool Bay.

Relations of
granite to
other rocks.

It is not proposed to discuss here the question of the origin of these granites, whether they are to be regarded as indigenous or exotic. It may, however, not be out of place to say that the descriptions given by Sir Archibald Geikie of the rocks of the south-east of Ireland, and which are regarded by him as intrusive, would seem to apply, almost word for word, to the granites of south-western Nova Scotia, as regards both their character and their relations to the associated strata. Everywhere along the borders of the several areas described, the granites may be seen to penetrate the inclosing beds in irregular tongue-like masses, sometimes coinciding accurately, both in dip and strike, with the inclosing strata, and at others cutting them at all angles; sometimes holding large detached blocks of the schistose strata and again forming with the latter a complicated network. A transition from granite to gneiss is sometimes observable, but in most instances the granite and the associated rock, whether gneiss or quartzite, are sharply differentiated. Again, there would seem to be no good reason for regarding the granites of Annapolis and Digby counties as different in age or origin from those of Queen's and Shelburne, with which they are directly continuous; but while in the latter counties they penetrate only Cambrian strata, in the former they clearly penetrate and alter the fossiliferous rocks of the Devonian system. As these latter clearly rest in Digby county upon the Cambrian rocks, the granites must have passed through these in order to reach the more recent strata, and must, therefore, in a literal sense, be intrusive, even if we suppose that their presence is the result of extravasation by pressure from a mass of underlying rocks altered *in situ*.

THE CAMBRIAN SYSTEM.

Summary of
results.

The results attained with reference to this system in the region under discussion embrace: (1) The accurate delineation of the areas occupied by these rocks in relation to the granite and (in Digby county) to the fossiliferous Devonian; (2) the determination of the suc-

cession of these rocks ; (3) the establishment of the identity of the more highly metamorphic rocks (gneisses, mica-schists, &c.) of Queen's and Shelburne counties, with the less altered sedimentary rocks, found in portions of the same counties ; (4) the determination of the absence, in any part of the four south-western counties, of any rocks older than those of the Cambrian system ; and lastly (5) the establishment of the exact parallelism of the Cambrian rocks of Digby county with those of the southern coast. To the above may be added (6) the approximate determination of the position and structure of the more important folds or anticlinal domes into which the Cambrian strata have been compressed. A few remarks may be made upon these several points.

(1) The position and limits of the Cambrian system will be best understood by reference to the sketch map which accompanies this report. It will be sufficient to say here that with the exception of the granite, the very small areas occupied (in Digby county) by Devonian rocks, and the narrow belt of Triassic sandstone and traps of Digby Neck, no other system finds representation over the entire area to which the report relates. Considering that the Cambrian system is also the gold-bearing system of the province, the importance of this determination will be readily appreciated. Distribution.

(2) As regards the succession of the Cambrian beds, these are readily divisible here, as to the eastward, into two main groups, viz., a lower principally arenaceous or quartzite group, of light colour ; and an upper slaty one which is usually dark coloured and highly pyritous. A peculiar feature is, however, here met with, which, though found strongly developed in some parts of Lunenburg county, does not seem to have been prominently noticed to the eastward. This is that between the quartzites proper and the black pyritous slates is a considerable body of slaty beds which not only differ from both, but which, under different circumstances, present, more particularly as regards colour, wholly diverse aspects. Thus the beds occupying this position and which become coarser in a downward and finer in an upward succession, ordinarily present a characteristic greenish-gray tint, apparently due to disseminated chlorite ; but associated with them at certain points (and at others occurring, often over considerable areas, to the exclusion of all other strata) are found slates in which this green tint is replaced by shades of blue, yellow and purple, often so arranged as to determine a delicate but conspicuous banding or ribbanding of the rocks. So different are these aspects, that for a time it was supposed that these brightly coloured and ribbanded beds were a different and newer series than the Cambrian, but a very careful study of the stratigraphy eventually sufficed to show that they are simply different Succession.

aspects of equivalent strata. According to this view the complete Cambrian succession, as seen in Queen's county, will be as follows:—

ASCENDING SUCCESSION OF CAMBRIAN STRATA.

1. Quartzite Division.

- (a) Heavily bedded blue quartzites, with slightly plumbaginous partings, alternating with numerous but much thinner beds of gray argillite. In metamorphic areas the quartzites become more micaceous, assuming the aspect of fine-grained gneisses, while the finer beds become glistening mica-schists.
- (b) Greenish-gray sandstones or quartzites, less massive than in (a), and alternating with slates which are arenaceous below, but become gradually more argillaceous above.

2. Slate division.

- (a) Greenish-gray slates, becoming bluish or light gray, and passing into purple slates, or becoming clouded or zoned with shades of green, purple, blue, buff or pale yellow, often producing a conspicuous ribbanding of the beds. The occurrence of light yellowish-green seams is a characteristic feature of the purple slates.
- (b) Bluish-gray and blue slates, with lighter gray seams or bands, and including in places an upper zone of purple slates.
- (c) Black, with some blue or gray slates, often highly pyritous. In metamorphic regions the green slates are represented by chloritic and hornblendic schists (or locally by conglomerates with a micaceous or hornblendic base); the slaty beds by micaceous, garnetiferous and andalusitic schists.

Equivalency
of altered and
unaltered
strata.

3. That the highly metamorphic rocks, such as gneisses, mica-schists, &c., which skirt the entire coast of Queen's county, and spread over so large a portion of Shelburne, are the equivalents of the less altered beds of central Queen's and Lunenburg counties, is conclusively proved by, (1), the fact that it is impossible to draw any line of demarcation between them; (2), by the fact that while in the metamorphic area the finer beds have assumed the aspects of glittering mica-schists, or are studded with garnets, staurolites, &c., the interstratified quartzites are often quite undistinguishable from those of the little altered areas; and (3), from the fact that the structure of the folds by which they have been affected and the succession of the beds are in accordance

with a single system. The fact that even the most highly altered portions of the system are of the nature of true sediments is shown, not only by the alternation of the beds, but by the occasional occurrence of layers of distinctly rounded pebbles, with evidences of false bedding, and in one instance by the occurrence of markings, unquestionably identical with those which have been elsewhere regarded as organic, under the name of *Asteropolithon*. This remarkable occurrence, of impressions believed to be due to living creatures in rocks filled with all the results of prolonged crystallization, may be seen upon the shore of Lockeport Island.

4. We come now to consider the question of the existence, within the region under discussion, of rocks older than those of the Cambrian system. Possible existence of pre-Cambrian rocks.

It has by some writers been suggested that a portion at least of the gneissic and schistose rocks, so prominently developed in portions of Queen's and Shelburne counties may be of Laurentian age. It is, however, almost needless to say that there is no evidence whatever to support such a view, while there are abundant facts, as already mentioned, which show that the strata in question are only portions of the Cambrian system, altered in proximity to granite.

Somewhat greater probability is attached to the view that the peculiar rocks found in the vicinity of the city of Yarmouth, and which are especially characterized by the abundance of hornblende which they contain, may belong to the Huronian system. The pre Cambrian age of this belt of rocks was suggested by Sir J. Wm. Dawson,* and was regarded as probable by Dr. Selwyn.† The writer also was, at the time of his first examination of the strata in question, disposed to concur in this view of their age. A more careful study, however, of the stratigraphy of the whole region has, as he believes, made it clear that they, too, are to be referred to the Cambrian system. It would be out of place to narrate here, in detail, the data upon which this conclusion is based; but it may in general be said that the Yarmouth City rocks form only one among several belts of like character, crossing the county along nearly parallel lines, and that the relations of these to the associated strata, which otherwise exactly resemble those of Queen's county, are such as to show that they are part of the same series, being probably the equivalent of the green slates which directly overlies the quartzites. It is true that no instance has been seen of the direct superposition of the hornblendic strata upon the latter, but all observations of this character are in Yarmouth county made very difficult by Rocks of Yarmouth.

* Supplement to Acadian Geology, 2nd edition, p. 88.

† Notes and Observations upon the Gold Fields of Nova Scotia. Report of Geological Survey, 1871, pp. 272, 273.

the widespread covering of drift; while at the few points where the contact of the quartzites with overlying beds has been observed, these have been invariably found to be green slates, followed, as in Queen's county, by bluish or black pyritous slates. It may be added that in the abundance of mica, staurolite and andalusite which characterize the beds not only at Yarmouth but at Pubnico (the latter being part of a second belt), they are quite like many of the altered Cambrian rocks of Shelburne county, while the abundance of hornblende rather than of chlorite, which further marks them, may well be only an accident of metamorphism. The fact of their being to a considerable extent conglomerate is a more important feature of contrast, such pebble beds being almost unknown elsewhere in the Cambrian of south-western Nova Scotia. But conglomerates, as is well known, are apt to be local, and even among the beds in question are very unequally developed. It may be added, that many of the more hornblendic beds are obviously intrusive, and many of the pebbles in the conglomerates are composed of quasi-igneous rocks.

Cambrian age
of the rocks of
Digby county.

5. In the map accompanying the Acadian Geology of Sir William Dawson, as well as in more recent maps based upon the latter, the larger part of Digby county is represented as occupied by rocks of Upper Silurian age, this reference being based upon their supposed continuity with the fossiliferous rocks of King's and Annapolis counties. Fossil-bearing slates, probably of Oriskany age, do indeed pass into Digby county, as will be presently noticed, but it is certain that they occupy a very limited area, while there is every reason to believe that the greater part of the rocks before assigned to this horizon are much older, and really appertain to the Cambrian system. In support of this view it is only necessary to refer to the admirable section of these rocks afforded by the Sissiboo or Weymouth River, or to the beds exposed in Marshalltown, Jordantown and the Joggin, near Digby. Not only do these rocks agree with the Cambrian rocks of Queen's county in general character, but also in the order of their succession and in their minuter details. Thus to the south-east of the head of St. Mary's Bay, and within two miles of the town of Digby, we find the lower quartzites dipping easterly. As we approach Marshalltown bands of green slate, more or less metamorphosed, appear, and gradually become the prevailing rock. These are followed in the high land of Marshalltown by purple slates which are the exact counterpart, in every particular, of the purple slates of Queen's county. The lower purple slates have in both cases the same pale yellowish-green seams with faint bedding lines or, occasionally, a very narrow deep green seam, and in both these are followed by an upper series of purple slates.

without such seams. To these succeed bluish-gray and light gray striped slates, seen on the north-east end of Marshalltown hill, while on the hill south of Jordantown and along the brook above the Valley Mills is seen the transition to the black slates. A fine exposure of the latter is seen near the railway bridge at tide level on the Grand Joggin. They are soft, argillaceous and somewhat pyritous.

All of the above beds, and with the same orderly sequence, have been traced westwardly to the valley of the Sissiboo, south of Weymouth, and beyond the latter into the county of Yarmouth. In an easterly direction they probably include a portion of the beds at the mouth of Bear River and Clementsport. Sissiboo River.

6. A very considerable portion of the time occupied in the exploration of the western counties has been devoted to working out the folds by which the region has been affected, and the determination of the more important anticlinals, so intimately connected with the success of the gold-mining industries. This has, in Queen's county, been effected with some degree of completeness (as illustrated in the accompanying map), the main difficulty here being the want of easy access to large portions of the area; but in Shelburne and Yarmouth, and to some extent in Digby, there are the added difficulties due to excessive metamorphism and widespread and deep accumulations of drift. A study of the folds as determined and laid down upon a map shows, as might be expected, evidence of a predominant pressure exerted at right angles to the major axis of the peninsula and to the trend of the southern coast, the quartzite domes which usually mark the courses of the anticlines exhibiting a general parallelism with the latter; but at the same time their forms, varying from nearly circular in some instances to elongated ellipses in others, together with the complex corrugations and blendings of the slates in the intervening synclines, show also the operation of other forces more or less oblique to the first. In Shelburne county the larger folds show also a marked tendency to the assumption of courses which are more nearly meridional, and this same feature is repeated in Yarmouth county, these courses being here approximately parallel to the course of the great granite axis which lies along the line dividing these two counties. It also seems probable that in some instances at least granite belts are coincident with or are the continuation of anticlinal ridges. Faults are abundant and like the folds strike in various directions, but none of great magnitude have as yet been noticed. Foldings. Faults.

THE DEVONIAN SYSTEM.

Our work upon the rocks of this system is still incomplete. Some progress has, however, been made in the direction of enlarging the area

in which these rocks are known to occur, and in their more accurate delimitation. Our knowledge of their contained fauna has been considerably increased.

Devonian in
Sissiboo
valley.

Prior to the work of the Survey no certain knowledge seems to have been had of the extension of these fossiliferous rocks to the westward of Bear River valley, while it was customary to regard either as Silurian or Devonian all the rocks of this valley, and the region thence to St. Mary's Bay. As has, however, already been pointed out in the present report, a large part of the strata so referred are really much more ancient. On the other hand the rocks of this formation have now been identified by fossils as far west as Mistake Settlement on the upper part of the Sissiboo Valley, south of Weymouth. The basin which they here occupy is small, and is separated from that of Bear River, much as this is separated from that of Nictau, by a northerly projecting spur of granite. That this latter rock is, however, more recent than the Devonian strata, is sufficiently evidenced by the partial metamorphism of the latter, as well as by the fact (admirably illustrated near Alpina Station on the Central Railway at the head of Nictau River), of the actual protrusion of enormous granite masses directly through the sedimentary beds. It is a noticeable fact in this connection, that while in the southern counties the Cambrian rocks show evidences of profound alteration at distances of a mile or more from any visible outcrop of granite, the beds at Nictau, even within a few rods of this rock, and even when completely inclosed by it, show hardly any change, and still preserve recognizable fossils. This would seem to indicate that the granite in the southern counties generally underlies a comparatively thin covering of schistose rocks, now unequally denuded; or possibly, that metamorphism has occurred more readily and through greater distances in a vertical than in a lateral direction.

Relation of
Devonian
rocks to
granite.

Large additions have been made to collections of fossils previously obtained from the rocks above noticed, and these bear out the general conclusions as to their age long ago published by Sir J. Wm. Dawson, who referred the iron ore series of Nictau, Moose River and the fossiliferous beds near the mouth of Bear River to the lower Devonian (Oriskany), an underlying series at Nictau to the Silurian, and the limestone and shales of New Canaan to a lower horizon in the Silurian (Niagara)*. Dr. H. M. Ami, who has examined the collections in the Peter Redpath Museum and those in the possession of the Geological Survey, supplies the following note upon the fossils:

Fossils.

"The palæontological evidence at hand from the Nictau district shows the existence there of strata which are for the most part refer-

* Acadian Geology, p. 498 et seq.

able to the Devonian system. The following forms are present in several of the collections:—*Spirifera urenosa*, *S. arrecta*, *Leptocælia flabellites*, *Leptostrophia magnifica*. These are clearly of lower Devonian age and are selected from a considerable number of species as characteristic of that age. The New Canaan limestones, as they are called by Sir J. Wm. Dawson, however, have furnished an assemblage of forms which point to the Silurian, rather than to the Devonian epoch.

"A preliminary study has been made of ten different collections and provisional lists of fossils prepared from each. These include, Nictau proper, section along the railway near Nictau, Wheelock's Farm, Moose River, Bear River and Mistake Settlement. The collections were made by Mr. Weston of the Geological Survey and by Sir J. Wm. Dawson many years ago, and latterly, in 1892, by Dr. L. W. Bailey, and Mr. W. H. Prest. The fossils are as a rule badly preserved and crushed in various directions.

"1. *Nictau*.—With the exception of the New Canaan limestone fossils, the collections from this region are referable to the lower or Eo-Devonian epoch. The most complete collection is to be found in the Peter Redpath Museum, and contains twenty-two species of fossils. The fauna consists for the most part of brachiopods, trilobites being very rarely seen.

"The strata along the railway section have afforded a number of lamellibranchiate shells, as have also those at Meadow Vale where Mr. T. C. Weston collected some interesting slabs of fossiliferous rock in 1879. At Wheelock's Farm a transitional series occurs.

"2. *Bear River*.—A very interesting collection made by Dr. Bailey in 1892, has revealed the presence of some twenty-one distinct species of fossils, whose facies is that of a transitional series. Brachiopoda are predominant, whilst not a single trilobite has been recorded. The assemblage of forms, from a palæontological standpoint, would place the rocks from which they are derived, either at the summit of the Silurian or at the base of the Devonian epoch, the weight of evidence being perhaps in favour of the Eo-Devonian.

"4. *Mistake Settlement*.—Only a few obscure forms were obtained and recognized from this locality, so that the precise horizon to which these should be assigned has not been definitely ascertained."

TRIASSIC,

As regards the red sandstones usually referred to this system, with their associated traps, we have no new facts of sufficient importance to require mention here. We may, however, observe that in addition to admirable exposures of the sandstone skirting the trappean hills along

Red sand-
stones of St.
Mary's Bay.

the north side of St. Mary's Bay as well as at Digby, similar beds, but less prominently exposed, occur also at some points along the south side of the same great indentation. Their height also above the sea level, with a maximum of 100 feet, would indicate a former depression to a corresponding depth, and a consequent direct connection of St. Mary's Bay with Annapolis Basin.

Comparison
with
Blomidon.

As compared with the red sandstones of Minas Basin and Blomidon, those of Digby Neck differ in the entire absence in them as far as observed, of the gypseous layers which form so marked a feature of the former. The relation of the sandstones to the traps are, however, identical in both cases, the latter overlying the former in several successive sheets, and with a general, but slight, northward inclination.

Some obscure markings, resembling branching plants, have been observed in the sandstones of St. Mary's Bay, but nothing by which their age may be definitely determined.

POST-TERTIARY.

Evidences of
glacial
erosion.

The features of the superficial geology of south-western Nova Scotia present many points of great interest, but these can only be briefly alluded to here. Among the more striking may be mentioned the deep transverse gorges of Digby Gut, Sandy Cove, Petit Passage, Grand Passage and others in Digby Neck, undoubtedly greatly modified by, if not wholly due to glacial action; the remarkable fiord-like indentations of the southern coast, with their numberless associated islands, to be ascribed to a like cause; the unusual depth of the glacial ploughings upon the same coast, some of the trenches there formed being twenty or more feet in depth; the wide distribution as well as the enormous size of travelled boulders, these being sometimes so numerous as to completely cover the surface of large areas and attaining in some instances a magnitude of 1,000 tons or more; the distance of transportation, exhibited in the occurrence of the characteristic North Mountain traps along the coast of Shelburne county, and of granite boulders on Briar Island; and last but not least, the wonderful development of kames. One of these has been traced for a distance of nearly thirty miles across the eastern part of Yarmouth county and part of Digby county, and others but little less remarkable occur.

ECONOMIC MINERALS.

Gold.—A number of important gold districts are found within the region to which this report relates.

These districts include, in Queen's county, those of Mologa, Whiteburne, North and South Brookfield, West Middlefield and Port Med-

way, with which, in the following remarks, may be associated the Pleasant River gold district near the western boundary of Lunenburg county.

The general conditions of the occurrence of gold at these several localities do not differ essentially from those previously discovered in the districts farther east. The auriferous quartz veins are partly in the form of bedded leads, *i.e.*, they form sheets conformable to the inclosing strata, and in part occur as "cross leads" or "angulars" intersecting the strata. The majority of the bedded leads are found in the quartzite division of the system, *i.e.*, either among the quartzites and interbedded slates, or among the greenish arenaceous slates which immediately succeed them, while they are rarely met with among the black slates, and appear to be quite absent among the pale blue and ribbanded beds. They are also most abundant and most productive in connection with anticlinal axes and the faults accompanying the latter. It may be added that the districts which are most productive, such as those of Molega, Pleasant River and Whiteburne, are those in which the evidences of metamorphism are least extreme, and within which granitic outcrops are wanting. Modes of occurrence.

The Molega mines are those which have attracted most attention, and at the time of our first visit (in 1891) were at the height of their prosperity. Not less than five companies were there represented, of which three were engaged in active operations. About 600 men found constant employment, and, with their families, gave to the otherwise inhospitable tracts, all the aspects of a busy and thriving community. Two years afterwards, upon a second visit, the largest of the mills, that of the Parker Douglas Company, owning an extensive plant, had stopped work. A large portion of the population had migrated to other regions, the hotel and boarding house had been burned, and a general air of depression was everywhere noticeable. Such a change is, of course, greatly to be deplored, and at first would seem to suggest that but little reliance is to be placed upon the results of gold mining in this section. But while such mining necessarily shares the uncertainty attending similar undertakings elsewhere, it must always be borne in mind that other causes than poverty of the veins may sometimes be at the bottom of apparent failures. Extravagant management, improper oversight, contests as to ownership, and want of technical knowledge may all contribute to such results; and it is noticeable that at the very time when some of the companies referred to had closed their doors, another (the Ballou Company) continued operations, and, apparently, with the most favourable results. Whatever the cause of decline, it is to be hoped that, in the near future, Molega may again

enter upon the course of prosperity which at one time seemed to have been assured.

The following facts relative to the Pleasant River and Brookfield mines are from notes of Mr. W. H. Prest, by whom the structure of both has been particularly studied, and are more recent than are contained in the report upon Queen's and Shelburne counties referred to in the letter of transmittal.

Pleasant
River and
Brookfield
mines.

"The chief differences between Pleasant River and Brookfield are these: The Pleasant River mines are on leads in quartzite and dark slate, while those of Brookfield occupy the transition from the quartzite to the green slate, both being a little higher in the system than the beds of Molega. The strata exposed at the Pleasant River mines are, in ascending order, (1st) quartzite and dark slates, (2nd) bluish and greenish-gray quartzite well developed, (3rd) greenish slates, slightly developed, (4th) black and dark blue argillites, covering a large area, and (5th) bluish and banded light and dark gray argillites crowned with purple slates. The lowest strata in Brookfield are bluish and greenish gray quartzites, the equivalents of the 2nd division at Pleasant River, but slightly developed. To these succeed greenish slates, of transitional character which contain the only gold-bearing leads found at Brookfield, and to these other green slates, without gold, here attaining a greater development than at Pleasant River. Finally, the series is crowned with black and blue slates.

"The principal differences between the two localities are in the strike, dip and probable origin of the more productive of the gold-bearing leads. Those of the Pleasant River mines surround an almost circular dome, and dip away from it at angles averaging 40 degrees. At Brookfield the principal lead crosses the eastern end of an elliptical fold at an angle of about 45 degrees. Thus the leads at Pleasant River represent the class of main or bedded leads, while those of Brookfield are an example of cross or fissure leads. However, a few cross leads or 'angulars' in the Pleasant River mines carry gold, while a few bedded leads at Brookfield do the same.

Brookfield.

"In the case of the Brookfield leads it has been further noticed (1) that only those bedded leads which dip towards or intersect the cross or fissure leads contain gold, (2) that those bedded leads which dip away from or do not intersect the said cross leads do not yield gold, (3) that those bedded leads which do carry gold become more and more barren as we recede from the neighbourhood of their junction with the cross leads, (4) that those bedded leads which are found in the western part of the district, although in the same geological

horizon as those intersecting the cross leads, have thus far proved barren, and (5) that those bedded leads which intersect the cross leads contain the same metal. From these several facts the conclusion is suggested that, in the case of the Brookfield area at least, the bedded leads have been mineralized from the great fissure or cross leads upon which nearly all the work in this vicinity has been done.

"It may be added that while the bedded leads all dip away from the apex of the anticline, the cross leads dip towards it. Thus the bedded leads often intersect the cross leads. The former curve with the quartzite and slate belts of the dome, but dip away from it at an angle of from 12 to 30 degrees, according to their position around the anticline.

"The deepest shaft at the Brookfield mines is on the 'McGuire' lead, and is nearly 300 feet. The south-east end of this lead varies in width from four inches to four feet, and the quartz also varies much in quality.

"The general course of the anticline at Brookfield is S. 60° W., and it seems to be subsidiary to the great Molega dome or fold.

"In the case of the Pleasant River mines the 'Dunbrach lead,' near the east end of the district, once showed quartz of phenomenal richness, some of it yielding in the neighbourhood of \$3,000 per ton. It did not, however, last long, and the false hopes thus raised eventually led to considerable loss. At the time of our visit to this vicinity, the works were all standing idle." Pleasant River.

"The Whiteburne mines, like those of Molega, from which they are distant about twelve miles in a westerly direction, are situated in the quartzite division of the Cambrian system, but not far below where these quartzites graduate into greenish arenaceous slates. The veins are for the most part bed veins, and, with the inclosing strata, which are here much better exposed than at Molega, dip northerly (N. 10° W. < 40°) with great regularity. At the eastern end of the property, however, there are some irregularities. The leads vary from five inches to ten inches in width, and are said to carry, upon an average, about \$20 to the ton of gold. Some leads, however, have been said to run as high as \$150 per ton. Several companies own properties here, and upon each occasion of our visiting the district, work was being vigorously and confidently prosecuted. No facts, however, of sufficient general interest to require notice here had been developed. Whiteburne mines.

The only other point in Queen's county where operations have gone beyond mere prospecting is that of Westfield, where mills were erected only to be abandoned almost immediately, now standing as a melancholy monument of mistaken judgment. Westfield.

Shelburne. In Shelburne county no gold mines have yet been opened, nor is the writer aware that any successful prospecting has been effected here. This is in accordance with the view, already stated, that extreme metamorphism and proximity to granite bosses are unfavourable to the occurrence of auriferous veins.

Yarmouth county. In Yarmouth county attempts at gold mining have been made at four different points, viz., Carleton, Kempt, Chegoggin Point, near Yarmouth, and Cranberry Head. The Kempt mine is in greenish-gray arenaceous slates overlying quartzites, the horizon being thus similar to that of Brookfield in Queen's county. As with the latter also the veins are chiefly fissure veins, crossing the bedding planes at various angles. Such veins are usually very variable in size, dip, strike and quantity of gold, and such seems to have been their character at Kempt mine. Kempt; for while very promising leads have in several instances been struck, the results as a whole have not been satisfactory, and the working of the mine has been irregular and desultory. At the "Cowan" mine, half a mile south-west from the Kempt mine, the veins, which occur in the same greenish slates, appear to be more regular, but the results of their removal have been equally unsatisfactory. The same Carleton mine. remarks apply also to the Carleton mines, except that these are in beds of an horizon a little lower than those of Kemptville. It is noticeable that the beds carrying these auriferous veins at Kempt and Carleton all occur on the northern side of a single anticlinal traversing a considerable portion of Yarmouth county in a south-westerly direction.

Cranberry Head and Chegoggin. The mines at Chegoggin Point and Cranberry Head are chiefly interesting as marking the great extent of the area which in Nova Scotia is more or less auriferous, and secondly as helping to confirm the view that the inclosing strata are of Cambrian age, although here presenting an aspect somewhat different from what is elsewhere seen in the rocks of that system.

At Chegoggin Point the rock is a gray quartz-like material, though hardly a true quartzite, and is remarkable as containing an immense vein of pure white quartz, the bounding planes of which are strikingly slickensided. Eighty-seven paces from the first another large mass of quartz occurs which is not less than twenty-six paces across. On the first bed a quartz mill of ten stamps was erected in 1890, and from it a large amount of rock was removed and crushed, but we have no definite information as to the yield of gold. It could hardly have been satisfactory, as in 1892 the works had already been abandoned. Similarly at Cranberry Head anticipations seem to have gone ahead of good judgment, and a deserted mill, surrounded by water-filled pits

and heaps of rubbish, now alone marks the site of a considerable but useless expenditure of capital.

In Digby county reports of the occurrence of gold have been made from time to time, but nothing of a trustworthy character is known, and nothing beyond prospecting has been attempted.

Iron.—The only ores of iron so far observed within the four south-western counties to which this report particularly relates occur on Digby Neck, in connection with the great beds of Triassic trap which form the larger part of that peninsula. They are all in the form of veins, usually running in a northerly direction, or at right angles to the course of the trappean ridge, and are very irregular as to width and persistency. They consist in part of magnetite and in part of octahedral hæmatite or marlite, a probable pseudomorph of magnetite. They often exhibit in connection with the associated minerals (which include quartz in various forms, calcite and zeolites), a markedly banded or zoned arrangement parallel to the boundary walls of the veins, which seemingly indicates that these are mostly of the nature of segregation veins. Several attempts have been made to work the ores, as near Digby, at Nicholl's mine in Rossway and at Johnson's mine in Waterford, but owing to the small size of the veins and the expense of working, the undertakings were soon abandoned.

Iron mines of Digby.

Ornamental Stones.—The trappean rocks of Digby Neck, like those of similar character east of Digby Gut, are remarkable for the number of quartzose and zeolitic veins which traverse them. The former include almost all varieties of quartz, such as rock-crystal, amethyst, smoky quartz, agate, chalcedony and jasper; while the latter include stilbites of various shades of colour, thompsonite, heulandite, chabazite, &c. The best localities for both sorts of minerals are the vicinity of the iron mines referred to above.

Quartz and zeolites.

The abundance of garnet, staurolite and andalusite crystals in connection with the more metamorphic portions of the Cambrian system in the south-western counties constitutes a very noticeable feature of the latter. The garnets are, however, though clear, for the most part very small, and the other minerals named, though large, usually very coarse and quite unfit for ornamental purposes. Some remarkable beds of garnet-bearing schist occur upon the shore of Chegoggin Point, near the old gold mine, and carry cross veins of pure garnet associated with tabular crystals of menaccanite, and similar beds occur in the vicinity of Brazil Lake. The best locality for the collection of staurolite crystals is the western side of Shelburne Harbour in the settlement of Carleton.

Garnet, staurolite, &c.

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GEOLOGICAL SURVEY OF CANADA
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR

CHEMICAL CONTRIBUTIONS
TO THE
GEOLOGY OF CANADA
FROM THE
LABORATORY OF THE SURVEY

BY
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OTTAWA
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EXCELLENT MAJESTY
1895

To

ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S.,
Director of the Geological Survey of Canada.

SIR,—I beg to present, herewith, my report for the interval comprised between the date of my last and December 31st, 1893. It embraces only such portion of the work carried out in the Laboratory of this Survey, as has been considered likely to prove of general interest.

Some of the minerals referred to in the following pages, constitute important, and in some instances, valuable ores, whilst others are of more or less economic importance by reason of their meeting with application in the Arts and Manufactures. Seven of these had not previously been identified, and another although recognized not hitherto recorded, as occurring in Canada.

Of the work herein formulated, the analyses carried out by my assistants have been duly credited to them in the body of the report, those not otherwise designated having been made by myself.

I have the honour to be,

Sir,

Your obedient servant,

G. CHRISTIAN HOFFMANN.

OTTAWA, 29th November, 1894.

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CHEMICAL CONTRIBUTIONS

TO THE

GEOLOGY OF CANADA

FROM THE

LABORATORY OF THE SURVEY.

COALS AND LIGNITES.

[In continuation of previous reports on this subject—Report of Progress, 1882-83-84, Part M; Annual Report, 1885, Part M; Annual Report, 1887-88, Part T, and Annual Report, 1888-89, Part R.]

77.—LIGNITE.—From drift in river bed at "The Red Cliff," about seven miles below Prince Albert, North Saskatchewan River, district of Alberta, North-west Territory. Collected by Mr. J. B. Tyrrell. Lignite from drift in river bed, at the Red Cliff, North Saskatchewan River, N. W. T.

The material was in a more or less finely comminuted condition; about fifty per cent, by weight, of the same passing a mesh of sixteen holes to the linear inch, the remainder consisting of very variously sized, irregularly shaped, more or less rounded fragments, the largest of which, a rounded flattened nodule, measured an inch and a quarter across.

Analysis by fast coking gave:

Hygroscopic water.....	10·12
Volatile combustible matter.....	35·98
Fixed carbon.....	47·27
Ash.....	6·63

100·00

Coke, per cent..... 53·90

Ratio of volatile combustible matter to fixed carbon 1:1·31

It yields a non-coherent coke. Colour of the ash, brownish-yellow.

Coals and lignites, *cont.* 78.—COAL.—From the Similkameen River, six or eight miles south of Vermilion Forks, Yale district, province of British Columbia.

Coal from the Similkameen River, B. C.

Examined for Mr. J. M. Buxton.

Analysis by fast coking gave :

Volatile matter.....	50.13
Fixed carbon.....	42.67
Ash.....	7.20
	100.00

Coke, per cent.....	49.87
---------------------	-------

It yields a firm coherent coke. Colour of the ash, brownish-yellow. The finely powdered fuel imparted a brownish-yellow colouration to a boiling solution of caustic potash.

Coal from Elk River, B. C. 79.—COAL.—From the fifteen-foot seam on Elk River, Crow Nest Pass, Rocky Mountains, province of British Columbia.

Analysis by fast coking gave :

Volatile matter.....	21.76
Fixed carbon.....	68.20
Ash.....	10.04
	100.00

Coke, per cent.....	78.24
---------------------	-------

It yields a non-coherent coke. The gases evolved during coking burnt with a yellowish, slightly luminous, smokeless flame. Colour of the ash, white.

Coal and semi-anthracite from Panther or Little Red Deer River, N. W. T. 80.—COAL AND SEMI-ANTHRACITE.—From Panther or Little Red Deer River, foot-hills at base of main limestone range of Rocky Mountains, district of Alberta, North-west Territory. Seam eleven feet thick, but much folded and broken. Collected by Mr. W. B. M. Davidson.

The material of the sample examined varied considerably in character, and was in this regard separable into two distinct portions. Of these, the one had a compact, highly contorted, structure; showed slickensides in an eminent degree; was made up of layers of a grayish-black, somewhat dull, and jet-black coal of brilliant lustre, and by fast coking gave a firm compact coke—whereas the other portion had a crumpled, foliated structure; was much slickensided; colour, grayish-black, somewhat dull, and by fast coking gave a non-coherent coke.

Analysis, by fast coking, of a fair average sample of the foregoing material, gave :

Hygroscopic water.....	1.87
Volatile combustible matter	13.74
Fixed carbon.....	79.56
Ash.....	4.84

100.00

Coke, per cent 84.39

Ratio of volatile combustible matter to fixed carbon 1 : 5.79

Coals and lignites, *cont.*

Coal and semi-anthracite from Panther or Little Red Deer River, N. W. T., *cont.*

It yields a firm coherent coke. The gases evolved during coking burnt with a yellow, luminous, somewhat smoky flame. Colour of the ash, white, with a faint reddish tinge—it does not agglutinate at a bright red heat, but at a most intense red heat it becomes fritted.

- 81.—SEMI-ANTHRACITE.—From foot-hills, first branch of Panther or Little Red Deer River, to east of base of main Rocky Mountain Range, one mile above confluence with Panther or Little Red Deer River, district of Alberta, North-west Territory. Seam four feet thick, and horizontal. Collected by Mr. W. B. M. Davidson.

Semi-anthracite from Panther or Little Red Deer River, N. W. T.

Structure lamellar, made up of irregularly alternating layers of a grayish-black, somewhat bright, and dense, jet-black coal of brilliant lustre—compact; brittle; fracture, uneven; hard and firm; when suddenly heated decrepitates, but not very considerably.

Analysis by fast coking gave :

Hygroscopic water.....	1.52
Volatile combustible matter	11.65
Fixed carbon.....	81.16
Ash.....	5.67

100.00

Coke, per cent 86.83

Ratio of volatile combustible matter to fixed carbon 1 : 6.97

It yields a non-coherent coke. The gases evolved during coking burnt with a yellowish, somewhat luminous, all but smokeless flame. The ash, which is almost pure white, does not agglutinate at a bright red heat, but at a most intense red heat becomes fritted.

This fuel is very similar in composition to the semi-anthracite—of which an analysis is given in the Annual Report of this Survey for 1885, p. 10 M—from a seam on the right bank of the Bow River, one mile and a half from Canmore station, C. P. R., section 29, township 24, range 10, west of the fifth initial meridian, district of Alberta, North-west Territory.

Coals and lignites, *cont.*

Coal from Camp Robertson, Graham Island, B. C.

82.—COAL.—From Camp Robertson, about six miles and a half north of Skidegate Inlet, and two miles and three-quarters west of Yakoun Lake, section 20, township 5, Graham Island, Queen Charlotte Islands, province of British Columbia. Geological position—Cretaceous.

Structure compact; colour, grayish black; lustre, resinous; fracture irregular; hard and firm; powder, brownish-black; it communicates only a just perceptible yellowish tinge to a boiling solution of caustic potash.

Analysis by fast coking gave:

Hygroscopic water.....	0.80
Volatile combustible matter.....	23.27
Fixed carbon.....	51.39
Ash.....	24.54
	100.00

Coke, per cent..... 75.93

Ratio of volatile combustible matter to fixed carbon 1 : 2.21

It yields, by fast coking, a firm coherent coke. The gases evolved during coking burnt with a yellow, luminous, very smoky flame. Colour of the ash, pale dull reddish-brown.

Coal from Camp Wilson, Graham Island, B. C.

83.—COAL.—From Camp Wilson, about fifteen miles north of Skidegate Inlet, section 36, township 9, Graham Island, Queen Charlotte Islands, province of British Columbia. Geological position—Cretaceous.

Structure, compact; colour, grayish-black; lustre, resinous to sub-vitreous; fracture, irregular; hard and firm; powder dark brown inclining to blackish-brown; it communicates a faint brownish-yellow colour to a boiling solution of caustic potash.

Analysis by fast coking gave:

Hygroscopic water.....	1.06
Volatile combustible matter.....	43.48
Fixed carbon.....	46.01
Ash.....	9.45
	100.00

Coke, per cent..... 55.46

Ratio of volatile combustible matter to fixed carbon 1 : 1.06

It yields, by fast coking, a firm coherent coke. The gases evolved during coking burnt with a yellow, luminous, very smoky flame. Colour of the ash, faint reddish-white.

This fuel may be from another exposure of the same seam as that from which the coal, of which an analysis is given in the Annual Report of this Survey for 1887-88, p. 17 T, was taken.

- 84.—ANTHRACITE.—From Camp Anthracite, about five miles and a half north of Skidegate Inlet and three miles and a half west of Yakoun Lake, section 17, township 5, Graham Island, Queen Charlotte Islands, province of British Columbia. Geological position—Cretaceous.

Coals and lignites, cont.
Anthracite from Camp Anthracite, Graham Island, B. C.

Structure, compact—shows slickensides in an eminent degree; colour, grayish-black; lustre, bright; brittle; fracture sub-conchoidal; powder black, slight grayish tinge; it communicates a faint brownish-yellow colouration to a boiling solution of caustic potash; when suddenly heated it decrepitates somewhat.

Analysis by fast coking gave:

Hygroscopic water	1.52
Volatile combustible matter	8.69
Fixed carbon	80.07
Ash	9.72
	100.00

Ratio of volatile combustible matter to fixed carbon 1 : 9.21

It yields a non-coherent coke; when heated in a covered crucible it evolves a small amount of gases which burn with a slightly yellowish, smokeless flame. Colour of the ash, reddish-brown.

- 85.—ANTHRACITE.—From the same locality as the preceding specimen.

Structure, compact; colour, grayish-black; lustre, bright; brittle; fracture, conchoidal; powder grayish-black, almost black; it communicated but a scarcely perceptible colouration to a boiling solution of caustic potash; when suddenly heated, decrepitates slightly.

Anthracite from Camp Anthracite, Graham Island, B. C.

Analysis by fast coking gave:

Hygroscopic water	2.85
Volatile combustible matter	7.59
Fixed carbon	68.25
Ash	21.31
	100.00

Ratio of volatile combustible matter to fixed carbon 1 : 8.99

It yields a non-coherent coke; the small amount of gases evolved during coking, burnt with a pale yellowish, smokeless flame. Colour of ash, light gray.

The specimen of this fuel received for examination was associated with a somewhat large proportion of a dark gray shale, hence the high percentage of ash and water shown in above analysis. The anthracite freed from associated rock matter, was found to contain only 1.33 per cent of water and but 6.50 per cent of ash.

MISCELLANEOUS MINERALS.

1. NATIVE PLATINUM.

Platinum,
native, from
Rock Creek,
Kettle River,
B. C.

A sample of heavy black sand taken from the ripples of sluice-boxes at Camp McKinney, Rock Creek, a tributary of Kettle River, Osoyoos division of Yale district, province of British Columbia, and which contained, in addition to gold, apparently a large proportion of native platinum, has been examined by Mr. Johnston, and found to have the following composition :

Native platinum.....	44.7
Gold	1.8
Magnetite.....	47.4
Quartzose sand	6.1
	100.0

The platinum was in the form of exceedingly minute to moderately coarse, irregular shaped grains, the largest of which measured four millimetres in diameter. Of the above 44.7 per cent platinum found in this material, 5.4 per cent was strongly magnetic; 15.7 per cent but feebly magnetic, and the remaining 23.6 per cent non-magnetic. No free osmiridium was observed; on dissolving a portion of the platinum, however, there remained numerous minute, thin, shining, steel-gray coloured scales of this alloy. The gold occurred in small, very irregular shaped grains, the largest not exceeding two to two and a half millimetres in diameter. The associated sand consisted of very fine grains of ash-gray coloured quartz, with a few intermixed grains of a light reddish coloured garnet, and an occasional grain of pyrite. A little chromite was in one instance detected in one of the pellets of platinum, and on another occasion very small quantities of a white felspathic rock was observed under similar conditions.

2. LEPIDOMELANE.

Lepidomelane
from Marmo-
ra, Hastings
county, Ont.

This mineral, the occurrence of which in Canada was first recognized by Mr. R. R. A. Johnston, in 1888, is found in considerable quantity, in aggregations of brilliant black plates or scales, in a fine granular arsenopyrite at the Bob Neill mine on lot fourteen of the tenth concession of the township of Marmora, Hastings county, province of Ontario. An analysis of a specimen from this locality afforded Mr. Wait the following results :

Silica.....	32.79
Alumina.....	14.34
Ferric oxide.....	4.52
Ferrous oxide.....	26.32
Manganous oxide.....	0.29
Lime.....	1.45
Magnesia.....	4.68
Potassa.....	7.24
Soda.....	2.00
Titanium dioxide.....	0.92
Water, at 100° C.....	1.38
Water, above 100° C. (direct estimation).....	3.68
	99.61

The specific gravity, at 15.5° C., was found to be.... 3.19

Miscellaneous
minerals, *cont.*

Lepidomelane
from Marmo-
ra, Hastings
county, Ont.,
cont.

Lepidomelane also exists abundantly, in the form of brilliant black scales and scaly aggregates, in quartz, at the Feigle mine on lot sixteen of the eleventh concession of the township of Marmora; and it has also been observed, in the form of brilliant black foliated masses and hexagonal tables, the latter sometimes ten to twelve millimetres in diameter, in specimens of the sodalite met with in nepheline-syenite on lot twenty-nine of the thirteenth, and lot twenty-five of the fourteenth concession of the township of Dungannon, also in Hastings county. Likewise, in brilliant black scaly aggregates in a fragment of associated pentlandite, nickeliferous pyrrhotite, and chalcopyrite, from the Worthington mine on lot two of the second concession of the township of Drury, district of Algoma, which, with the aforementioned localities, is in the province of Ontario.

3. ACTINOLITE.

A light greenish-gray, fine-fibrous, massive actinolite from the township of Westmeath, Renfrew county, province of Ontario, has been examined by Mr. Wait, and found to have a specific gravity, at 15.5° C., of 2.941, and—agreeably with the results of his analysis—the following composition:

Actinolite
from West-
meath, Ren-
frew county,
Ont.

Silica.....	56.70
Alumina.....	1.62
Ferric oxide.....	3.06
Ferrous oxide.....	7.19
Manganous oxide.....	0.30
Nickelous oxide.....	0.54
Lime.....	10.62
Magnesia.....	17.20
Potassa.....	0.24
Soda.....	0.64
Water, at 100° C.....	0.64
Water, above 100° C. (direct estimation).....	2.06
	100.80

Miscellaneous
minerals, *cont.*

4. ANDRADITE.

Andradite
from Cawood,
Pontiac coun-
ty, Que.

From the township of Cawood, Pontiac county, province of Quebec.

Massive ; colour, black by reflected light, dark purplish-red in thin
splinters ; lustre, brilliant ; brittle. Specific gravity, at 15·5° C., 3·690.

An analysis by Mr. Wait gave :

Silica	36·09
Alumina	12·69
Ferric oxide	12·33
Ferrous oxide	3·30
Manganous oxide	0·48
Lime	34·46
Magnesia	0·94
Water, at 100° C.	0·04
	100·33

5. ANDRADITE.

Andradite
from near
Foster's Bar,
Fraser River,
B. C.From near Foster's Bar, about twenty-three miles above Lytton,
Fraser River, Yale district, province of British Columbia.Massive, very finely granular ; colour, clove-brown ; lustre, dull
resinous ; tough. Specific gravity, at 15·5° C., 3·706. An analysis by
Mr. Wait showed it to have the following composition :—

Silica	34·52
Alumina	4·09
Ferric oxide	25·82
Ferrous oxide	2·66
Manganous oxide	0·94
Lime	31·49
Magnesia	0·59
Water, at 100° C.	0·03
	100·14

6. GROSSULARITE.

Grossularite
from Litch-
field, Pontiac
county, Que.From the twelfth lot of the first range of the township of Litchfield,
Pontiac county, province of Quebec.A massive garnet, of a honey-yellow colour, vitreous lustre, and a
specific gravity, at 15·5° C., of 3·623. Agreeably with the results
of an analysis conducted by Mr. Wait, its composition is as follows :

Silica	36·80
Alumina	20·53
Ferric oxide	2·38
Ferrous oxide	0·56
Manganous oxide	0·50
Lime	37·41
Magnesia	1·51
Water, at 100° C.	0·07
	99·76

Miscellaneous
minerals, *cont.*

7. HORNBLLENDE.

A fine fibrous, radiated, confusedly aggregated, massive, blackish-green hornblende, from near Foster's Bar, about twenty-three miles above Lytton, Fraser River, Yale district, province of British Columbia,—has been examined by Mr. Wait, and found to have a specific gravity, at 15.5° C., of 3.404, and—agreeably with the results of his analysis—the following composition :

Silica.....	38.79
Alumina.....	11.51
Ferric oxide...	16.88
Ferrous oxide ..	15.96
Manganous oxide.....	0.62
Lime.....	11.57
Magnesia.....	2.86
Potassa	1.36
Soda	0.71
Water, at 100° C.....	0.09
Water, above 100° C. (direct estimation).....	0.83
	101.18

8. CLINOCCHLORE.

Colour, white or faint bluish-white ; lustre, pearly ; in thin laminae, transparent ; specific gravity, at 15.5° C., 2.631. Occurs in the form of scales and more or less broadly foliated aggregations, distributed through a rock composed of white scapolite and light green-yellow-green serpentine, found on lot twenty-four of the twelfth range of the township of Buckingham, Ottawa county, province of Quebec.

An analysis, by Mr. Johnston, conducted on carefully selected material, gave :

Silica.....	28.65
Alumina	18.96
Magnesia.....	37.49
Water (ignition).....	15.22
	100.32

The above specimen was collected by Mr. J. F. Torrance, who, at the time of writing his report on the apatite deposits of Ottawa county, provisionally referred the mineral in question, to pyrophyllite (Annual Report of this Survey, 1882-84, p. 20 J).

9. CLINOCCHLORE.

From the sixteenth lot of the seventh concession of the township of Bagot, Renfrew county, province of Ontario.

Clinocllore,
from Bagot,
Renfrew
county, Ont.

Miscellaneous
minerals, *cont.*
Clinocllore
from Bagot,
Renfrew
county, Ont.,
cont.

Structure, broadly foliated; colour, dark green; lustre, pearly; transparent—even in tolerably thick plates.

An analysis, by Mr. Johnston, gave the following results:

Silica.....	27.23
Alumina.....	19.44
Ferric oxide.....	2.17
Ferrous oxide.....	4.91
Chromic oxide.....	0.99
Magnesia.....	32.67
Potassa.....	0.08
Water (direct estimation).....	12.04
	99.53

10. TALC.

Talc from
Grimsthorpe,
Hastings
county, Ont.

Occurs on lots eight and nine of the fifth concession of the township of Grimsthorpe, Hastings county, province of Ontario. Presented to the Survey by Mr. A. Moon.

Structure, foliated massive; lustre, pearly on the cleavage surface; colour, pale yellowish-green; in thin laminae transparent; specific gravity, at 15.5° C., 2.65.

An analysis, by Mr. Wait, gave as follows:

Silica.....	60.45
Alumina.....	0.27
Ferric oxide.....	0.78
Ferrous oxide.....	2.04
Nickelous oxide.....	0.50
Lime.....	0.16
Magnesia.....	29.84
Water, at 100° C.....	0.32
Water, above 100° C. (direct estimation).....	5.42
	99.78

11. DIALLAGE.

Diallage from
Melbourne,
Richmond
county, Que.

A fine example of a thin-foliated, massive, light greenish-gray diallage, with a pseudo-metallic lustre, has been met with, in serpentine, by Mr. A. Webster, on the twenty-second lot of the second range of the township of Melbourne, Richmond county, province of Quebec.

Mr. Johnston found it to have a hardness of 3.5; a specific gravity, at 15.5° C., of 3.238, and—agreeably with the results of his analysis—the following composition:

Silica.....	50.66
Alumina.....	4.47
Ferric oxide.....	0.70
Ferrous oxide.....	2.75
Chromic oxide.....	1.40
Lime.....	21.81
Magnesia.....	17.45
Water (direct estimation).....	0.69
	99.93

12. COBALTIFEROUS LÖLLINGITE.

Miscellaneous
minerals, *cont.*

From the sixteenth lot of the fourteenth concession of the township of Galway, Peterborough county, province of Ontario. Received from the late Mr. J. B. Campbell, July 21, 1888.

Cobaltiferous
löllingite from
Galway,
Peterborough
county, Ont.

The mineral, which was associated with a small quantity of pyrrhotite and a little white translucent quartz, was massive and exhibited only in parts, and that but very indistinctly, any approach to crystalline structure. Colour, steel-gray; lustre, metallic; brittle; fracture uneven; streak, grayish-black; specific gravity (after correction for a little included quartz), at 15.5° C., 7.028.

An analysis, by Mr. Johnston, of carefully selected material, afforded the results given under I. Deducting the gangue (silica) and recalculating the remaining constituents for one hundred parts, we obtain the figures given under II.

	I.	II.
Arsenic	70.11	70.85
Sulphur	0.80	0.81
Iron.....	24.41	24.67
Cobalt...	2.85	2.88
Nickel	0.78	0.79
Gangue (quartz).....	1.69	....
	100.64	100.00

This mineral had not previously been identified as occurring in Canada. If found in quantity it would, by reason of its cobalt and nickel, be of some economic importance.

13. BISMUTHINITE.

From a coarse granite vein on the twenty-first lot of the north range of the road leading to Kaskouia, township of Jonquière, Chicoutimi county, province of Quebec. Collected by Mr. C. W. Willimott.

Bismuthinite
from Jon-
quière, Chi-
coutimi
county, Que.

A lead-gray coloured, foliated massive bismuthinite, with metallic lustre, in a gangue composed of white and pale flesh-red, indistinctly laminated, perthite, a more or less smoky quartz, and a hair-brown (pale yellowish-gray in thin laminae, by transmitted light) muscovite, with some black tourmaline and brownish-red spessartite.

Miscellaneous
minerals, *cont.*
Bismuthinite
from Jon-
quière, Chi-
coutimi coun-
ty, Que., *cont.*

Mr. Johnston found it to have a specific gravity, at 15.5° C., of 6.781 and—agreeably with the results of his analysis—the following composition :

Sulphur	18.46
Bismuth	79.28
Lead	1.68
Copper	0.48
Iron	0.74
	100.64

This mineral has already been recognized as occurring, but in limited quantity only, in the provinces of Nova Scotia, Ontario and British Columbia.

14. DAMOURITE.

Damourite
from Kicking
Horse Valley
B. C.

This mineral, not previously recognized as occurring in Canada, has been identified by Mr. Johnston as a constituent of a rock specimen from the Kicking Horse Valley, Rocky Mountains, East Kootanie district, province of British Columbia, which had been forwarded to the Survey for assay.

It occurred in the form of yellowish-green scaly aggregations, unctuous to the feel, and of a pearly lustre, in a gangue consisting of an association of a ferruginous dolomite with small quantities of quartz and a little calcite, containing, here and there, a few particles of pyrite, and, in parts, coated with ferric hydrate.

Mr. Johnston found it to have a specific gravity, at 15.5° C., of 2.857, and, conformably with the results of his analysis, the following composition :

Silica	44.28
Alumina	33.60
Ferric oxide	0.62
Magnesia	3.03
Potassa	9.87
Soda	0.40
Fluorine	0.59
Chlorine	0.51
Water	6.25
	99.13
Less oxygen, equivalent to fluorine and chlorine	0.36
	98.77

In detail, the water determination was as follows :

Loss on drying over sulphuric acid	0.68
Subsequent loss on drying at 100° C.	0.03
Further loss on ignition	5.54
	6.25

15. SERICITE-SCHIST.

From the Wait-a-bit Creek which flows into the Columbia River, about two miles north of Donald, East Kootanie district, province of British Columbia, where, according to the collector, Mr. J. J. Driscoll, surveyor, it constitutes extensive rock masses, intersected by quartz veins. Material from some of these latter was found to consist of a white sub-translucent quartz, with inclusions of a white, occasionally light reddish, opaque, cleavable calcite, and small quantities of chalcocite, chalcopyrite, a little pyrrhotite, and a few small crystals of pyrite.

Sericite-schist
from Wait-a-
bit Creek,
Columbia
River, B. C.

The schist has a foliated structure, a light brownish-gray to light reddish-brown colour, a faintly glistening lustre, and an unctuous talc-like feel. A portion of the same was finely pulverized and treated with cold dilute hydrochloric acid (dilute nitric acid where the estimation of chlorine was involved) which removed 38.36 per cent, essentially carbonates, and left a very fine scaly residue, of what proved to be sericite, amounting to 61.64 per cent.

An analysis by Mr. Johnston, of the soluble portion of the rock, showed it to have the following centesimal composition :

Lime	31.12
Magnesia	5.84
Ferric oxide	13.66
Ferrous oxide	5.43
Potassa	0.05
Soda	2.79
Carbonic acid	35.41
Sulphuric acid	0.10
Phosphoric acid	0.10
Silica	0.96
Chlorine	0.10
Water, at 100° C.	1.80
Water, combined	2.64
	100.00

The residue from the hydrochloric acid treatment was next examined, and with the results given under the following heading.

16. SERICITE.

This, the material above referred to as constituting the insoluble portion of the sericite-schist, consisted of very minute scales of a yellowish-brown, translucent, micaceous mineral.

Sericite from
Wait-a-bit
Creek, Col-
umbia River,
B.C.

Miscellaneous lowish-white colour and pearly lustre. An analysis of the same, after minerals, *cont.* drying at 100° C., afforded Mr. Johnston the following results :

Sericite from
Wait-a-bit
Creek, Col-
umbia River,
B. C., *cont.*

Silica	46.05
Alumina.....	38.36
Ferric oxide.....	0.97
Lime.....	2.40
Magnesia.....	0.47
Potassa.....	6.19
Soda	2.98
Lithia.....	0.34
Caesia	0.03
Water (direct estimation).....	2.48
	100.27

17. COOKEITE.

Cookeite from
Wait-a-bit
Creek, Col-
umbia River,
B. C.

This was met with in the form of thin layers in the afore-mentioned sericite-schist, and was also found in small cavities in the quartz veins which traverse it.

It occurs in crystalline, foliated, translucent masses, of a faint grayish-white to white, or silvery-white and pale apple-green colour. In thin folia it is colourless and transparent; lustre, pearly; feel, greasy. Before the blow-pipe it exfoliates like vermiculite and colours the flame intense carmine-red; in the closed tube gives off water and affords a reaction for fluorine; it is slightly fusible, and gives a blue colour with cobalt solution; with salt of phosphorous it gives a skeleton of silica.

A carefully conducted analysis, by Mr. Johnston, upon apparently pure material, gave :

Silica	32.00
Alumina	45.87
Lime	1.63
Magnesia.....	0.78
Lithia	2.10
Potassa	0.06
Soda.....	0.65
Fluorine.....	0.02
Water	17.29
	100.40
Less oxygen, equivalent to fluorine.....	0.01
	100.39

18. STRONTIANITE.

Strontianite
from Nepean,
Carleton
county, Ont.

Some very fine examples, one of which weighed twenty-one pounds, of this mineral have been met with by Mr. C. W. Willimott, on the thirty-first lot of concession A, of the township of Nepean, Carleton

county, province of Ontario—where, so far as his observations have extended, two veins at least, of from four to six inches in width, with a tendency to increase in width with depth, occur traversing the Chazy limestone.

Miscellaneous
minerals, *cont.*

Strontianite
from Nepean,
Carleton
county, Ont.,
cont.

The mineral, which entirely fills the veins, has a radiating crystalline massive structure, the foci of the separate divergent groupings being at either wall of the vein, the radial structure of each group extending thence inward, meeting and interlacing at their extremities with those of the similar groupings of the opposite side of the vein—or, failing that, as was occasionally found to be the case, and in the cavities thus formed, terminating in radiating groups of acicular crystals of from five to nine millimetres in length. Colour, pale yellow-green shading into white; translucent; specific gravity, at 15.5° C., 3.704.

An analysis by Mr. Johnston, upon carefully selected material, consisting of crystals, dried at 100° C., gave:

Carbonic acid	30.54
Strontia.....	65.43
Lime.....	3.38
Insoluble.....	0.17
	99.52

For economic uses of this mineral, see Strontianite, under Mineralogical Notes (note 24), beyond.

19. NATIVE IRON.

This occurrence, to which my attention was first drawn by Mr. R. L. Broadbent, was observed in some specimens of perthite, collected by Mr. A. E. Barlow in 1893, from a pegmatite vein on lot seven, concession B, of the township of Cameron, district of Nipissing, province of Ontario.

Iron, Native,
from Cameron,
district of
Nipissing,
Ont.

The perthite, consisting of inter-laminated brownish-red to reddish-brown orthoclase and reddish-white albite, contained, here and there, inclusions of a grayish-black, massive, feebly magnetic, partially altered, manganiferous magnetite, affording a dark reddish-brown streak.

Portions of the felspar showed marked signs of weathering, the albite more especially being more or less kaolinised. Imbedded in the kaolin, also in the dark reddish-brown limonite in immediate proximity to it, were observable numerous spherules of a steel-gray colour and metallic lustre. These spherules varied greatly in size, a few measuring as much as a millimetre in diameter, the greater number, however, being of far smaller dimensions and many of microscopic minuteness. They were almost perfectly spherical in shape; strongly magnetic; very hard,

Miscellaneous
minerals, *cont.*

Iron, Native,
from Cameron,
district of
Nipissing,
Ont., *cont.*

indenting and scratching a hardened steel mortar; brittle; when pulverized emit a distinct phosphoretted odour; immersed in a solution of cupric sulphate, become coated with a film of metallic copper. They were readily attacked by hydrochloric acid, with evolution of hydrogen and a strong odour of phosphine, leaving an insoluble residue consisting of light brownish coloured spherules which on ignition become perfectly white. These spherules, which form the nuclei of the metallic looking grains, have, apparently, a concretionary structure.

Mr. Johnston found the metallic spherules to have a specific gravity, at 15.5° C., of 7.257, and a composition, as follows:

Iron	90.45
Manganese	0.75
Nickel	trace.
Sulphur	} undet.
Phosphorus	
Organic matter	
Insoluble, non-metallic, residue	7.26
	98.46

Cobalt and copper were sought for and found to be absent. He found the insoluble, non-metallic, residue to contain 88.77 per cent of silica, a little alumina and ferric oxide—not estimated, a very small quantity of lime and possibly some magnesia.

This occurrence recalls to mind that observed by me in a specimen of Huronian quartzite from the north shore of St. Joseph Island, Lake Huron, Ontario, the results of the examination of which appeared in the Transactions of the Royal Society of Canada, vol. VIII., 1890, sec. III., p. 39.

The spherules under consideration differ from those of the St. Joseph Island occurrence in that the metallic layer coating the siliceous nucleus is slightly thicker, giving the globules a higher specific gravity and somewhat different composition, containing but a trace of nickel and no cobalt or copper. Apart from this, there is nothing to lead to an inference that the metallic globules of the two localities have other than a community of origin.

MINERALOGICAL NOTES.

- Alunogen. 1.—Alunogen. Has been found in the form of white and faintly yellowish, silky, delicate fibrous masses on a grayish, somewhat pyritiferous, quartzo-felspathic rock, near Spatum, on the line of the Canadian Pacific Railway; also, in pale yellowish to white, cellular, mammillary crusts, about four miles west of Savona

station, on the same line of railway, in Yale district, and Dr. G. M. Dawson has met with it in pale ochre-yellow to white, crystalline, cellular masses, at the mouth of Fountain Creek, Fraser River, province of British Columbia. Mineralogical notes, cont.

- 2.—Silver, Native. The material in question was found at a depth of about twenty-eight feet from the surface and immediately underlying the deposit of sphalerite on lot ten, range four, of Calumet township, Pontiac county, province of Quebec. It consisted of an association of a white, grayish-white, and dark gray quartz and a little dark-green diabase, through which was disseminated numerous laminæ of native silver. It occurred, sparingly, both massive and in small octahedral crystals in the cavities of a specimen of much honeycombed grayish-white quartz, presented by Mr. Ruecau to Mr. E. D. Ingall, from fifteen miles south-east of Bear Lake, Kaslo-Slocan mining district, West Kootanie, province of British Columbia. Silver, Native.

- 3.—Steatite. A pale grayish-greenish-white, sub-translucent steatite, has been found at the Nith mine, Illecillewaet River, nearly opposite Illecillewaet station, on the line of the Canadian Pacific Railway, West Kootanie district, province of British Columbia. A very pale greenish-white steatite slightly seamed with ferric hydrate and containing, here and there, minute cavities filled with the same mineral, occurs at Stewartdale (Brigend) Mills near Whycomagh, Inverness County, and a greenish-gray sub-translucent steatite has been met with by Mr. Hugh Fletcher at Eagle Head, Gabarus Bay, Cape Breton county, in the province of Nova Scotia. Steatite.

- 4.—Celestite. The specimen forwarded to the Survey for examination consisted of a bluish-gray crystalline-granular massive celestite, in parts stained and permeated by ferric hydrate. It forms a bed about a foot in thickness, in Carboniferous limestone, on the right bank of Sydney River, about a mile and a half above Sydney Bridge, Cape Breton county, province of Nova Scotia. The occurrence is referred to by Mr. Hugh Fletcher in his report on explorations and surveys in Cape Breton, which appeared in the Report of Progress for 1875-76, pp. 399, 417. Celestite.

- 5.—Spinel. Small irregular shaped particles and more or less well defined octahedrons of translucent blue spinel occur, with grains of a yellowish-white garnet, scales of mica and graphite and a little

Mineralogical
notes, *cont.*

serpentine; disseminated through a white, coarsely crystalline dolomitic limestone found on lot sixteen in the tenth range of the township of Portland West, Ottawa county, province of Quebec.

- Arquerite. 6.—Arquerite. Is mentioned by Dr. G. M. Dawson (Ann. Rep. Geol. Surv. Can., vol. iii., 1887-88, part R), as having been met with, in washing for gold, in several localities in the province of British Columbia, the most noteworthy being the Omenica district, where considerable quantities have been found in the form of scales and nuggets, with placer gold, particularly upon Vital and Silver creeks. The material of a sample from Vital Creek consisted of almost uniformly flattened grains and small nuggets of very irregular contour and varying in size from three to seventeen millimetres in their greatest diameter, and in weight from a little under a decigram to two or slightly over two grams. The maximum size and weight here mentioned is sometimes, if not frequently, exceeded—occasionally greatly so; an elongated flattened nugget, from Vital Creek, of a dull silver-white colour and which, apart from a few pittings, presented a comparatively smooth surface, measuring eighty-eight by forty-nine by nine millimetres and weighing 184.6 grams. An analysis of the material from Vital Creek afforded H. G. Hanks, silver 86.15, mercury, 11.90, silica, 0.45 = 98.50, and a nugget from this district, analysed by Riotte and Leckhardt of San Francisco, was found to contain: silver 83.30, mercury, 11.00, lead 0.40, copper 0.20 = 94.90, as well as traces of gold, platinum and iron.
- Mountain leather. 7.—Mountain leather. Some very pretty specimens of this mineral of a light grayish to white colour, attached to a colourless, transparent, cleavable calcite, have been met with in the shaft of the Lake Girard mica mine on lot twenty-three of the second range of the township of Wakefield, Ottawa county, province of Quebec.
- Cuprite. 8.—Cuprite. Has been recognized as occurring in some specimens of copper ore from the ninth lot of the ninth range of the township of Sutton, Brome county, province of Quebec. These consisted of bornite with small, radiating crystalline masses of grass-green malachite, and, intimately associated with the latter, a hyacinth-red, brownish-red and tile-red, granular or earthy cuprite, in a gangue consisting of an association of white, sub-translucent to translucent quartz with some dark gray mica-schist.
- Sulphur, Native. 9.—Sulphur, Native. A specimen of pyrite, from the fifth lot of the fourth concession of the township of Darling, Lanark county,

which had been exposed for some time to the atmosphere of a damp cellar, was found to have become, in parts, covered with a bright lemon-yellow incrustation of sulphur; and a pale yellowish-grayish-white, earthy, slightly compacted, almost pure sulphur, resulting from the decomposition of pyrite, was found occupying cavities in a white translucent quartz from the third lot of the first concession of Denbigh, Addington county, province of Ontario.

Mineralogical
notes, cont.

- 10.—Chabazite. Pale wine-yellow and white crystals of chabazite have been met with, by Mr. H. P. Brumell, in the cavities or fissures of a vein, composed of pyroxene, biotite, scapolite and a little quartz and calcite, cutting granitic rock on lots twenty-four and twenty-five of the sixth concession of the township of Mont-eagle, Hastings county, province of Ontario.
- 11.—Chrome-magnesia mica. A very pretty, bright grass-green mica which entered largely into the composition of the gangue of a specimen of nickeliferous pyrrhotite from lot six, of the first concession of the township of Hyman, district of Algoma, province of Ontario, has been examined by Mr. R. A. A. Johnston, and proved to be a chromiferous biotite.
- 12.—Morenosite. Occurs as a greenish-white and pale apple-green incrustation on associated gersdorffite, niccolite, chalcopyrite and pyrrhotite, at the O'Connor claim on lot twelve of the third concession of the township of Denison, district of Algoma, province of Ontario; also, but more sparsely, as a greenish-white incrustation on some of the nickeliferous ore of the Worthington mine on lot two of the second concession of the township of Drury in the same district.
- 13.—Pyrargyrite, dark red silver ore, was observed as occurring in small aggregations, scattered through a purplish-bluish-gray, very finegranular galena—locally known as 'steel ore'—obtained by Mr. E. D. Ingall, from the Dardanelles claim, five miles south of Bear Lake, Kaslo-Slocan mining district, West Kootanie, province of British Columbia. This mineral had not previously been met with in Canada.
- 14.—Anglesite. Was recognized by Mr. Johnston as occurring, in the form of small colourless translucent to sub-transparent rhombic octahedrons, with crystals of cerussite, implanted on the surface of a specimen of very fine granular galena, presented by Mr. Hector

Mineralogical
notes, *cont.*

McRae to the Survey, from the Wellington mine, two miles and a half north-east of Bear Lake, Kaslo-Slocan road, West Kootanie district, province of British Columbia. This mineral had not previously been identified as occurring in Canada.

- Tennantite. 15.—Tennantite. Among other specimens received for examination was a sample of ore from the ninth lot of the ninth concession of the township of Barrie, Frontenac county, province of Ontario, which was found to consist of a slightly argentiferous, somewhat coarse granular, massive tennantite, through which was disseminated a small quantity of quartzose gangue. More recently samples of ore have been sent by other parties which were taken respectively from lots six, seven and eight, in addition to nine, of aforementioned concession and township. These all consisted of tennantite similar to that above described, the specimens differing from each other only in the nature of the gangue, which consisted either exclusively of a fine granular dolomite or of a quartz-felspathic rock, or of an association of these or of the dolomite with a white sub-translucent quartz.
- Cerussite. 16.—Cerussite. Was identified by Mr. Johnston as occurring in the form of small white sub-transparent to transparent crystals, together with crystals of anglesite, on the surface of a specimen of very fine granular galena, presented to the Survey by Mr. Hector McRae, from the Wellington mine, two miles and a half north-east of Bear Lake, Kaslo-Slocan road, West Kootanie district, province of British Columbia; also, in yellowish-white to white, translucent to sub-transparent penetration twins, producing stellate forms, occurring, according to Mr. E. D. Ingall by whom the specimen was collected, in cavities in the galena at the Beaver mine, twelve miles west of Kaslo, on the abovementioned Kaslo-Slocan road.
- Calamine, Electric. 17.—Calamine, Electric. Has been identified by Mr. Johnston, as occurring in the form of small, brilliant, colourless, transparent, elongated tabular crystals having vertically striated faces, in radiating groups in cavities in a grayish-white cryptocrystalline quartz, obtained by Mr. E. D. Ingall, from the Skyline claim, two miles west-south-west from Ainsworth, West Kootanie district, province of British Columbia; and a confused loosely aggregated mass of similar crystals, containing in its interstices green carbonate of copper and some ferric hydrate, was met with, and presented by Mr. Ruecau to Mr. Ingall, eight miles east-south-east of the upper forks of Carpenter Creek, which flows into Slocan Lake, also

in the West Kootanie district. This mineral had not previously been recognized as occurring in Canada. Mineralogical
notes, cont.

- 18.—Hydrous nickel arsenate. Some specimens of gersdorffite which had lain in the drawers of a mineral cabinet for about a couple of years, were found to have undergone a partial decomposition, with formation of a hydrous nickel arsenate. The material, which came from the O'Connor claim on lot twelve of the third concession of the township of Denison, district of Algoma, province of Ontario, consisted of gersdorffite, with here and there a few scattered particles of chalcopryrite, in a gangue of grayish-white to white translucent quartz, with which was associated small quantities of a fine grained diabase and chloritic schist. The nickel arsenate, which occurred both lining and filling cavities in the gersdorffite, was in the former case, in the form of botryoidal, globular or mammillary crusts of a greenish-yellow, pale grass-green, and honey-yellow to brownish colour and, exteriorly of a sub-vitreous to vitreous lustre; whilst that filling the cavities was compact and amorphous, texture colloid, of a greenish-yellow colour and waxy lustre, also occasionally, but more rarely, earthy, chalk-like and dull. Hydrous
nickel
arsenate.
- 19.—Lepidolite. Has been identified by Mr. Johnston as occurring in aggregations of white, translucent, pearly scales, with small crystals of calcite, in cavities in a specimen of highly rust-stained quartz, collected by Mr. E. D. Ingall, from the Gold Hill claim, about ten miles north-east of Illecillewaet station, on the line of the Canadian Pacific Railway, West Kootanie district, province of British Columbia. This mineral had not previously been recognized as occurring in Canada. Lepidolite.
- 20.—Altaite. Amongst other specimens, presented by Mr. Ruecau to Mr. Ingall, was one, recognized by Mr. Johnston as consisting of massive altaite or lead telluride, in a gangue of white sub-translucent quartz, said by him to have been found six miles north of Liddle Creek, Kaslo River, West Kootanie district, province of British Columbia. This mineral was not previously known to occur in Canada. Altaite.
- 21.—Opal, Common. A slightly bluish-white, in parts, faint bluish-green, sub-translucent, milk-opal, with a vitreous lustre, was presented to Mr. Ingall by Mr. Ruecau, as coming from three miles and a half south-east of Four-mile Creek, Slocan Lake, West Kootanie district, province of British Columbia. Opal,
Common

Mineralogical
notes, cont.

Arsenolite.

22.—Arsenolite. This was found by Mr. R. A. A. Johnston to enter very largely into the composition of a more or less heavy, white, in parts dull yellowish coloured, incrustation which occurred on a specimen of native arsenic from seven miles up Watson Creek, west side of the Fraser River, twenty-five miles above Lillooet, province of British Columbia. It has also been recognized by Mr. Johnston as occurring in the form of a more or less thick incrustation upon a specimen of arsenopyrite from mining location W. R. III., in township 40, south-east side of Lake Wahnapiatae, district of Nipissing, province of Ontario. The occurrence of this mineral in Canada had not previously been observed.

Jamesonite.

23.—Jamesonite. Amongst other specimens received for identification, were some good examples of a fibrous massive jamesonite from the seventh lot of the ninth concession, and tenth lot of the eighth concession, respectively, of the township of Barrie, Frontenac county, province of Ontario. Of these, that from the first mentioned locality was associated with a little chalcopyrite, and occurred in a gangue consisting of a fine-granular dolomite, with small quantities of quartz, and a little felspar; whilst that from the last mentioned locality, and from which the gangue had been removed, was associated with a little sphalerite.

Strontianite

24.—Strontianite. A fine example of this mineral, weighing some nine and a half ounces, in the form of a crust of from one and a half to two centimetres in thickness, having a prismatic crystalline structure, a pale yellow-green colour, and translucent, was found by Dr. G. M. Dawson on the property of the Horsetly Hydraulic Mining Company, Horsetly River, Cariboo district, province of British Columbia, where, as he informs me, "this mineral occurs incrusting boulders or filling irregular cavities in the lower or cemented portion of the auriferous gravels, and is also found disseminated in hard clayey concretionary masses formed beneath the auriferous gravels, in the decomposed superficial parts of the underlying Tertiary (Miocene) shales, which constitute the bed-rock at this mine."

The occurrence of strontianite in the township of Nepean, Carleton county, Ontario, has already been referred to in the preceding part of this report, where, under 'Miscellaneous minerals,' No. 18, a full description and analysis of the mineral from that locality will be found.

Strontianite, strontium carbonate, is of economic importance by reason of its employment for the manufacture of strontium hydrate, which is largely used in the preparation and refining of beet-root sugar, and in the extraction of crystallisable sugar from

molasses. It is also employed for the manufacture of strontium nitrate, a salt much used in pyrotechny. Mineralogical notes, cont.

- 25.—Cinnabar. What may prove to be an important deposit of this mineral, has been met with near the mouth of Copper Creek, Cinnabar. Kamloops Lake, province of British Columbia, where, according to Dr. G. M. Dawson, from observations made in 1894, it occurs in veins, largely composed of quartz and calcite with some dolomite and barite, traversing Tertiary volcanic rocks.

On the occasion of his visit to the above mentioned locality in 1892, Mr. E. D. Ingall obtained, at the Rosebush claim—where at that time some very encouraging showings of the ore had been exposed, several handsome specimens of the mineral. The finest of these—which weighed some six pounds six ounces, and contained, approximately, thirty per cent, by weight, of the mineral—consisted of a reddish-brown, sometimes cherry-red, more rarely cochineal-red coloured, granular massive cinnabar, with a few particles of pyrite, in a gangue consisting of an association of fine to somewhat coarse crystalline dolomite, with small quantities of a grayish-white felspathic rock, weathering brownish-yellow, and a little barite. In other specimens the gangue was composed of an association of white crystalline calcite, with a bluish-gray crypto-crystalline quartz and small quantities of the aforementioned felspathic rock. Stibnite may be referred to as an associated mineral, specimens of the same, in the form of radiating groups of acicular crystals in a gangue of white crystalline dolomite and barite, having been found by Dr. Dawson in some of the veins carrying cinnabar at the Rosebush claim.

ROCKS.

- 1.—A vesicular lava from Mount Franklin, Talbot county, Victoria, Australia. Collected by Dr. A. R. C. Selwyn. Lava from Mount Franklin, Victoria, Australia.

This was found—agreeably with the results of an analysis, conducted by Mr. Wait—to have the following composition :

Silica.....	44·85
Alumina.....	20·63
Ferric oxide.....	6·91
Ferrous oxide.....	5·10
Manganous oxide.....	0·41
Lime.....	8·69
Magnesia.....	6·27
Potassa.....	2·65
Soda.....	3·28
Water, at 100° C.....	0·69
Water, above 100° C.....	1·15
	100·63

Rocks, *cont.* 2.—Granites taken from different granite masses occurring at the
Granites from undermentioned localities in Halifax county, province of Nova
Halifax Scotia. Collected by Mr. E. R. Faribault, of the Survey, 1891 :
county, N. S.

1, From the east side of Ship Harbour ; 2, 3, and 4, from Beaver Dam Lake, Sheet Harbour road ; 5, 6, and 7, from one mile north of the Waverley gold mine. An average sample prepared from equal weights of each of these seven specimens of granite, was found by Mr. Wait, to have the following composition :

Silica.....	70.49
Alumina.....	17.47
Ferric oxide.....	1.14
Manganous oxide.....	trace.
Lime.....	1.71
Magnesia.....	0.57
Potassa.....	4.18
Soda.....	4.13
Water, at 100° C.....	0.15
Water, above 100° C.....	0.19

100.03

Andalusite and staurolite schists, etc., from Guysborough and Halifax counties, N. S. 3.—The following rocks, occurring in close proximity to masses of the same varieties of granite as the above, are from the undermentioned localities in Guysborough and Halifax counties. They were collected by Mr. Faribault, 1891 :

1, Slate from Larry's River, some two miles above the bridge ; 2, andalusite schist from Larry's River, one mile above the bridge ; 3, slate, from Larry's River, above lower bridge ; 4, slate, from Larry's River, at lower bridge ; 5, quartzite, from Country Harbour ; 6, altered quartzite, from the north end of Mount Misery ; 7, altered quartzite, from Mount Misery ; 8, andalusite schist, from Larry's River, two miles above the post office ; 9, staurolite schist, from Salmon River ; 10, breccia, from Mount Misery ; 11, andalusite schist, from Canso road, east of Fox Island post office ; 12, quartzite breccia, from Upper Liscomb River ; 13, andalusite schist, from point between American Cove and English Cove, Tor Bay ; 14, mica-schist, from Seven-mile Stream, Sheet Harbour, two miles above Indian road ; 15, altered quartzite, from the west side of Country Harbour, between Locusts Beach and Mount Misery. Of these localities, Nos. 9 and 14 are in Halifax county, and the remainder in Guysborough county.

An average sample prepared from equal weights of each of these fifteen rocks, was found by Mr. Wait to have the following composition :

Silica.....	62.11
Alumina.....	21.19
Ferric oxide.....	5.61
Manganous oxide.....	1.18
Lime.....	2.36
Magnesia.....	1.29
Potassa.....	3.59
Soda.....	2.12
Water, at 100° C.....	0.33
Water, above 100° C.....	0.62
	100.40

Rocks, *cont.*
Andalusite
and staurolite
schists, etc.,
from Guya-
borough and
Halifax
counties,
N. S., *cont.*

4.—Indurated clay, from Souris City, Souris River, province of Manitoba. Collected by Dr. A. R. C. Selwyn.

Indurated
clay from
Souris City,
Souris River,
Man.

Structure, compact. Colour, light bluish-gray. Lustre, dull. Smooth, but meagre to the touch. Adheres strongly to the tongue. Tough. Somewhat sonorous. Hardness, about 3. Fracture, irregular, occasionally imperfectly large conchoidal. Geological position, Cretaceous (Pierre formation).

Mr. Wait has made an analysis of this material, and with the following results :

Silica.....	79.55
Alumina.....	8.35
Ferric oxide.....	1.90
Lime.....	1.50
Magnesia.....	1.02
Potassa.....	1.16
Soda.....	0.01
Water, at 100° C.....	2.56
Water, above 100° C.....	3.50
	99.55

This rock may be ground, with tolerable facility, to a soft impalpable powder, which forms with water a more or less plastic mass. It is, as may be seen by the result of my experiments (Report of Progress of this Survey for 1880-82, p. 2 H) exceedingly well adapted for the manufacture of both ordinary building and fire brick—the latter proving exceedingly refractory. The material is so situate as to be readily accessible, and occurs in practically unlimited quantity.

LIMESTONES.

Continued from page 27 R of the Annual Report of this Survey (vol. iv.) for 1888-89.

The following Cambro-Silurian limestones are from some of the more important beds (here referred to in descending order) at Wright's (formerly Mahoney's) quarry, ward No. 1, city of Hull, township of Hull, Ottawa county, province of Quebec.

Limestone
from upper-
most bed,
Wright's
quarry, Hull,
Ottawa
county, Que.

- 8.—From the uppermost bed. This has a thickness of two feet. The material of the same, which is much broken, is chiefly, if not exclusively, used for the manufacture of lime.

Structure, somewhat fine-crystalline; colour, faintly brownish ash-gray.

It was found, by Mr. Johnston, to have the following composition :

(After drying at 100° C.—Hygroscopic water = 0.14 per cent).

Carbonate of lime.....	97.66	
“ magnesia.....	1.38	
“ iron.....	0.16	
Alumina.....	—	} 0.67
Silica, soluble.....	—	
Insoluble matter.....	0.67	
		99.87

Limestone
from third
bed, Wright's
quarry, Hull,
Ottawa
county, Que.

- 9.—From the third bed; thickness of the same, one foot three inches.

The stone is employed for building purposes.

Structure, somewhat fine-crystalline; colour, bluish-gray.

An analysis, by Mr. Johnston, showed it to have the following composition :

(After drying at 100° C.—Hygroscopic water = 0.09 per cent).

Carbonate of lime.....	96.25	
“ magnesia.....	2.18	
“ iron.....	0.32	
Alumina.....	0.05	} 1.33
Silica, soluble.....	0.07	
Insoluble matter.....	1.21	
		100.08

Limestone
from fifth bed,
Wright's
quarry, Hull,
Ottawa
county, Que.

- 10.—From the fifth bed; thickness of same, one foot two inches. The stone is employed for building purposes.

Structure, fine-crystalline; colour bluish-gray.

An analysis, conducted by Mr. Johnston, gave as follows :

(After drying at 100° C.—Hygroscopic water = 0.07 per cent).

Carbonate of lime.....	96.19
“ magnesia.....	1.72
“ iron.....	0.26
Alumina.....	0.05
Silica, soluble.....	0.09
Insoluble matter.....	1.60

99.91

Limestones,
cont.
Limestone
from fifth bed,
Wright's
quarry, Hull,
Ottawa
county, Que.

11.—From the tenth bed ; thickness of same, one foot six inches. The stone is employed for building purposes.

Structure, somewhat coarsely crystalline ; colour, faintly brownish ash-gray.

Agreeably with the results of an analysis, conducted by Mr. Johnston, it has the following composition :

(After drying at 100° C.—Hygroscopic water = 0.08 per cent).

Carbonate of lime.....	96.92
“ magnesia.....	1.59
“ iron.....	0.25
Alumina.....	0.07
Silica, soluble.....	0.02
Insoluble matter.....	1.97

100.82

Limestone
from tenth
bed, Wright's
quarry, Hull,
Ottawa
county, Que.

IRON ORES.

1.—Magnetite. From what has been described as a vein, twenty-five feet wide, on the north shore of West Redonda Island, Gulf of Georgia, province of British Columbia. Examined for Mr. Geo. De Wolf.

Magnetite
from West
Redonda
Island, Gulf
of Georgia,
B. C.

A grayish-black, highly magnetic, somewhat fine-crystalline granular, massive magnetite. Its analysis afforded Mr. Wait the following results :

Ferric oxide.....	62.952
Ferrous oxide.....	28.067
Manganous oxide.....	0.110
Potassa.....	0.080
Soda.....	0.230
Lime.....	2.234
Magnesia.....	1.300
Alumina.....	0.220
Silica.....	4.353
Phosphoric acid.....	none.
Sulphur.....	0.015
Titanic acid.....	none.
Water.....	0.045
	99.606
Iron, as ferric oxide.....	44.066
Iron, as ferrous oxide.....	21.830
Total metallic iron.....	65.896
Phosphorus.....	none.
Sulphur.....	0.015

- Iron ores, *cont.*
Magnetite from Big Turtle River, Ont.
- 2.—Magnetite. From Lake 'where the river bends,' Big Turtle River, district of Rainy River, province of Ontario. Collected by Mr. W. H. C. Smith.

A very fine-granular, massive magnetite. Mr. Wait found it to contain :

Metallic iron.....	40.17 per cent.
Insoluble matter.....	37.21 "
Titanic acid.....	none.

- Magnetite from Crooked River, Ont.
- 3.—Magnetite. From two miles south-west of intersection of south boundary of the township of Moss with Round Lake River—Crooked River, district of Thunder Bay, province of Ontario. This, and the two following specimens were collected by Mr. W. McInnes.

A fine-granular magnetite. Determinations by Mr. Wait, gave :

Metallic iron.....	42.57 per cent.
Insoluble matter.....	38.45 "
Titanic acid.....	none.

- Magnetite from south of Moss, Ont.
- 4.—Magnetite. From south of the township of Moss, a mile and a half west of locality of occurrence of the preceding specimen, district of Thunder Bay, province of Ontario.

A fine-granular magnetite. Examined by Mr. Wait it was found to contain :

Metallic iron.....	42.64 per cent.
Insoluble matter.....	38.63 "
Titanic acid.....	none.

- Magnetite from south of Moss, Ont.
- 5.—Magnetite. From south of the township of Moss, and north of locality of occurrence of the preceding specimen, district of Thunder Bay, province of Ontario.

A fine-granular magnetite. Mr. Wait found it to contain :

Metallic iron.....	51.20 per cent.
Insoluble matter.....	26.99 "
Titanic acid.....	none.

- Magnetite from vicinity of Little Pic River, Ont.
- 6.—Magnetite. From the vicinity of Little Pic River, Heron Bay, Lake Superior, province of Ontario. Examined for Mr. Morisseau.

It consisted of an intimate association of magnetite, quartz, and garnet, and, agreeably with determinations conducted by Mr. Wait, contained :

Metallic iron.....	42.22 per cent.
--------------------	-----------------

- 7.—Magnetite. From Green-water Lake, district of Thunder Bay, Iron ores, province of Ontario. Collected by Mr. W. McInnes. *cont.*

A very fine grained, almost compact, schistose magnetite. Magnetite from Green-water Lake, Ont.

Determinations by Mr. Wait gave :

Metallic iron	52·82 per cent.
Insoluble matter	22·31 “
Titanic acid	none.

- 8.—Clay iron-stone. From what has been designated the Christie Clay iron-stone from coal mine, section 10, township 5, range 1, west of the 5th initial Christie coal mine, district of Alberta, North-west Territory. *N. W. T.*

The material, which was of a grayish-black colour, was found by Mr. Wait to contain :

Metallic iron	33·32 per cent.
Insoluble matter	2·66 “

NICKEL AND COBALT,

Estimation of, in pyrrhotite from various localities in the provinces of Nova Scotia, Quebec, Ontario and British Columbia.—Continued from page 48 R of last Annual Report of this Survey, Vol. v., 1889-91.

- 1.—From the land of Mrs. Catherine O'Hanley, on the rear of Pyrrhotite George's River, and known as Rear of Leitch's Creek, Cape Leitch's Breton county, province of Nova Scotia. Examined for Mr. Leitch's Creek, Cape Alex. McLeod. Breton county, N. S.

The material consisted of pyrrhotite through which was disseminated a somewhat large amount of siliceous gangue. Mr. Wait found it to contain :

Nickel	0·75 per cent.
Cobalt	trace.

The gangue constituted 25·40 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0·10 per cent nickel.

- 2.—From lot two of the eighth range of the township of Eardley, Pyrrhotite Ottawa county, province of Quebec. Examined for Mr. W. A. from Eardley Allan. Ottawa county, Que.

A massive pyrrhotite. An analysis by Mr. Johnston showed it to contain :

Nickel	0·13 per cent.
Cobalt	none.

Nickel and
cobalt, *cont.*
Pyrrhotite
from Dalhousie,
Lanark
county, Ont.

- 3.—From the east-half of lot eighteen of the third concession of the township of Dalhousie, Lanark county, province of Ontario. Examined for Mr. W. C. Caldwell.

It consisted of an association of pyrrhotite with a small quantity of pyrite, in a gangue of quartz-mica-diorite. Mr. Wait found it to contain :

Nickel 0.09 per cent.
Cobalt trace.

The gangue constituted 20.50 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0.11 per cent nickel.

Pyrrhotite
from Anglesea,
Addington
county, Ont.

- 4.—From lot fifteen, range A of the township of Anglesea, Addington county, province of Ontario. Examined for Mr. B. Clark.

A dark gray gneissoid rock through which was disseminated a fairly large amount of pyrrhotite and a trifling quantity of copper-pyrites. Agreeably with the results of determinations made by Mr. Wait, it contained :

Nickel 0.10 per cent.
Cobalt trace.

The gangue constituted 37.89 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0.16 per cent nickel.

Pyrrhotite
from Galway,
Peterborough
county, Ont.

- 5.—From the twelfth lot of the third concession of the township of Galway, Peterborough county, province of Ontario. Examined for Mr. E. D. Orde.

A compact, massive, pyrrhotite. It was found by Mr. Wait to contain :

Nickel 0.16 per cent.
Cobalt trace.

Pyrrhotite
from Galway,
Peterborough
county, Ont.

- 6.—From the eighteenth lot of the fourth concession of the township of Galway, Peterborough county, province of Ontario. Collected by Dr. F. D. Adams.

A massive pyrrhotite in association with very small quantities of iron-pyrites, in a gangue of white sub-translucent quartz. The specimen, which was in parts thickly coated with ferric hydrate, weighed one pound nine ounces. Determinations by Mr. Johnston gave :

Nickel 0.10 per cent.
Cobalt trace.

The gangue constituted 17·25 per cent, by weight, of the whole. Nickel and Cobalt, *cont.*
The metalliferous portion of the ore contained, therefore, 0·12 per cent nickel.

- 7.—From the sixteenth lot of the fourteenth concession of the township of Galway, Peterborough county, province of Ontario. Examined for Mr. R. H. G. Chapman. *Pyrrhotite from Galway, Peterborough county, Ont.*

A compact, massive, pyrrhotite with which was associated a little pyrite and trifling amounts of copper-pyrites and quartz. Weight of sample, two pounds seven ounces. Mr. Wait found it to contain :

Nickel.....0·10 per cent.
Cobalt.....trace.

- 8.—From the south end of lot sixteen in the fourteenth concession of the township of Galway, Peterborough county, province of Ontario. Collected by Dr. F. D. Adams. *Pyrrhotite from Galway, Peterborough county, Ont.*

A massive pyrrhotite with which was associated very small quantities of copper-pyrites, quartz and felspar. Determinations by Mr. Johnston gave :

Nickel.....0·05 per cent.
Cobalt.....trace.

- 9.—From the sixteenth lot of the fifteenth concession of the township of Galway, Peterborough county, province of Ontario. Collected by Dr. F. D. Adams. *Pyrrhotite from Galway, Peterborough county, Ont.*

A white sub-translucent quartz, stained and coated with ferric hydrate, carrying some pyrrhotite and a small quantity of pyrite. Weight of sample, one pound three ounces. Mr. Johnston found it to contain :

Nickel.....faint trace,

The gangue constituted 38·46 per cent, by weight, of the whole.

- 10.—A further specimen from the township of Galway (number of lot and concession not communicated), consisting of a massive pyrrhotite through which was disseminated a very trifling amount of calcite, was examined by Mr. Wait and found to contain : *Pyrrhotite from Galway, Peterborough county, Ont.*

Nickel.....0·04 per cent.
Cobalt.....trace.

- 11.—From lot one of the eleventh concession of the township of Somerville, Victoria county, province of Ontario. Collected by Dr. F. D. Adams. *Pyrrhotite from Somerville, Victoria county, Ont.*

Nickel and
Cobalt, *cont.*

Pyrrhotite
from Somer-
ville, Victoria
county, Ont.,
cont.

An association of white sub-translucent quartz, with a little felspar and a very little garnet, carrying small quantities of pyrite and pyrrhotite. The specimen which was in parts thickly coated with ferric hydrate, weighed fifteen ounces. Mr. Johnston found it to contain :

Nickel.....faint trace.

The gangue constituted 62.36 per cent, by weight, of the whole.

Pyrrhotite
from Somer-
ville, Victoria
county, Ont.

- 12.—From the same township as the preceding specimen (number of lot and concession not communicated).

It consisted of pyrrhotite in a highly quartzose gangue, through which was disseminated a little garnet. Determinations by Mr. Wait gave :

Nickel..... 0.06 per cent.

Cobalt..... trace.

The gangue constituted 48.97 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0.12 per cent nickel.

Pyrrhotite
from Victoria
county, Ont.

- 13.—From one of the northern townships of Victoria county, province of Ontario.

A compact, massive pyrrhotite. Agreeably with the results of determinations made by Mr. Wait, it contained :

Nickel..... 0.15 per cent.

Cobalt..... trace.

Pyrite from
Vermilion
Lake, Ont.

- 14.—From Mr. E. V. Wright's claim on Vermilion Lake, north of east arm of Lake Temagami, district of Nipissing, province of Ontario. Collected by Mr. A. E. Barlow.

A very fine crystalline, massive iron-pyrites in a gangue of greenish-gray quartz-diorite. Mr. Wait found it to contain :

Nickel, with some cobalt..... 0.05 per cent.

Pyrrhotite
from Hyman,
Ont.

- 15.—From the sixth lot of the first concession of the township of Hyman, district of Algoma, province of Ontario. Examined for Mr. J. H. Bowman.

It consisted of pyrrhotite in a gangue very largely composed of a dark brownish and bright grass-green mica, with but little visible quartz. The pyrrhotite, freed from all gangue, was found by Mr. Johnston to contain :

Nickel..... 1.55 per cent.

Cobalt..... none.

- 16.—From belt of Huronian schist, etc., which crosses English River nine miles north of the line of the Canadian Pacific Railway, district of Rainy River, province of Ontario. Collected by Mr. W. McInnes. Nickel and cobalt, cont.
Pyrrhotite from English River, Ont.

A massive pyrrhotite through which was disseminated a small amount of quartz. Mr. Wait found it to contain :

Nickel..... 0·12 per cent.
Cobalt..... none.

The gangue constituted 10·50 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0·13 per cent nickel.

- 17.—From the vicinity of Jackfish station on the line of the Canadian Pacific Railway, district of Thunder Bay, province of Ontario. Pyrite from vicinity of Jackfish station, C.P.R., Ont.
- A very fine-granular, massive pyrite, with which was associated small quantities of pyrrhotite. An analysis by Mr. Wait showed it to contain :

Nickel..... trace.

- 18.—From the Illecillewaet district, West Kootanie, province of British Columbia. Pyrrhotite from the Illecillewaet district, B. C.

It consisted of pyrrhotite in association with a little copper-pyrites, through which was disseminated small quantities of a dark green rock. Determinations by Mr. Wait gave :

Nickel..... 0·12 per cent.
Cobalt..... trace.

The gangue constituted 16·75 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0·14 per cent nickel.

- 19.—From an unnamed creek flowing into Downie Creek, some twenty miles above its entry into the Columbia River, West Kootanie district, province of British Columbia. Examined for Mr. J. D. Boyd. Pyrrhotite from creek entering Downie Creek, Columbia River, B. C.

A dark gray quartzo-felspathic rock through which was disseminated a somewhat large amount of pyrrhotite. It was examined by Mr. Johnston and found to contain :

Nickel..... faint trace.

- 20.—From Crawford Bay, Kootanie Lake, Kootanie district, province of British Columbia. This, and the following specimen was examined for Cockle Bros. Pyrrhotite from Kootanie Lake, B. C.

Nickel and
cobalt, *cont.*

It consisted of pyrrhotite, together with a very trifling amount of copper-pyrites in a gangue of white sub-translucent quartz, with some fine scales of mica. It was found by Mr. Wait to contain :

Nickel..... trace.

Pyrrhotite
from Kootanie
Lake,
B. C.

- 21.—From the same locality as the preceding specimen.

It consisted of pyrrhotite, in association with small quantities of copper-pyrites and graphite, through which was disseminated small quantities of quartz, felspar and mica. Determinations by Mr. Wait gave :

Nickel..... 0.048 per cent.
Cobalt..... none.

The gangue constituted 10.70 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0.053 per cent nickel.

Pyrrhotite
from near
Savona station,
C.P.R.,
B.C.

- 22.—From a few miles north of Savona station on the line of the Canadian Pacific Railway, Yale district, province of British Columbia. Examined for Mr. J. Dickenson.

A massive pyrrhotite, through which was disseminated a few specks of copper-pyrites and a small quantity of quartz. An analysis, by Mr. Wait, showed it to contain :

Nickel..... 0.031 per cent.

The gangue constituted 10.17 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0.034 per cent nickel.

Pyrrhotite
from between
North
Thompson
and Clear-
water Rivers,
B.C.

- 23.—From between the North Thompson and Clearwater Rivers, province of British Columbia.

It consisted of pyrrhotite in association with small quantities of copper-pyrites. Mr. Wait found it to contain. :

Nickel..... trace.

Pyrrhotite
from Mission
City claims,
B.C.

- 24.—From Mission City claims, townships seventeen and eighteen, Westminster district, province of British Columbia. Examined for Mr. D. Elliott.

A massive, fine-granular pyrrhotite through which was disseminated small quantities of iron-pyrites and a little copper-pyrites, and a somewhat large proportion of quartz gangue. Determinations by Mr. Wait gave :

Nickel..... 0.055 per cent.
Cobalt..... trace.

The gangue constituted 36.50 per cent, by weight, of the whole. Nickel and cobalt, *cont.*
The metalliferous portion of the ore contained, therefore, 0.09 per cent nickel.

25.—From Jarvis Inlet, province of British Columbia.

Pyrrhotite
from Jarvis
Inlet, B.C.

An association of pyrrhotite with some copper-pyrites and a little galena, through which was disseminated a small proportion of gangue, composed of gray quartz and a fine grained green diorite. Agreeably with the results of determinations by Mr. Wait, it contained :

Nickel. 0.24 per cent.
Cobalt. trace.

The gangue constituted 14.80 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0.28 per cent nickel.

26.—From Deer River, a tributary of the Churchill River, North-west Territory. Collected by Mr. D. B. Dowling (Survey).

Pyrrhotite
from Deer
River,
N.W.T.

It consisted of pyrrhotite in a gangue composed of quartz, felspar, and a little mica and graphite. Mr. Wait found it to contain :

Nickel. 0.06 per cent.
Cobalt. trace.

The gangue constituted 42.20 per cent, by weight, of the whole. The metalliferous portion of the ore contained, therefore, 0.10 per cent nickel.

The results of analysis of a highly interesting cobaltiferous and nickeliferous variety of löllingite from the township of Galway, Peterborough county, province of Ontario, and which if found in any quantity would be of economic importance, will be found under No. 12 "Miscellaneous minerals" in the previous part of this report.

GOLD AND SILVER ASSAYS.

These were all conducted by Mr. R. A. A. Johnston

PROVINCE OF NOVA SCOTIA.

1.—From the so-called Huntington mine, west side of Chegoggin Point, Yarmouth county. Examined for Mr. J. D. Huntington.

An association of quartz, garnet and mica, with some molybdenite and a little chlorite. Weight of specimen, two pounds and a half.

It contained neither gold nor silver.

Gold and
silver assays,
cont.

PROVINCE OF NEW BRUNSWICK.

- 2.—This, and the following specimen is from Rocky Brook, Gloucester county, and was collected by Mr. H. P. Brumell.

Material representing an average sample of the ore from the vein. It consisted of a fine granular pyrrhotite together with some zinc-blende and mispickel disseminated through a gangue of grayish-white quartz. Weight of sample, two pounds fourteen ounces. Assays gave :

Gold.....distinct trace.
Silver.....5'950 ounces to the ton of 2,000 lbs.

3. Material representing richer pay streaks in vein. It consisted of zinc-blende with small quantities of pyrrhotite and mispickel in a gangue of white opaque quartz and dolomite. The gangue constituting but a small proportion of the whole. Weight of sample, one pound nine ounces. It contained :

Gold.....distinct trace.
Silver......43'750 ounces to the ton of 2,000 lbs.

- 4.—From Pollet River, one mile and a half from Aylwin Corner, Albert county. Examined for the Hon. A. R. McClellan.

An association of white sub-translucent quartz with a grayish-green chloritic schist, carrying small quantities of iron-pyrites.

Weight of sample, one pound two ounces.

It contained neither gold nor silver.

- 5.—From Sawmill Creek, parish of Hopewell, near Memel Settlement, Albert county. Collected by Mr. H. P. Brumell.

A light gray felsite, through which was disseminated numerous small grains of iron-pyrites. Weight of sample, two pounds four ounces.

It contained neither gold nor silver.

- 6.—From Peck's Creek, two miles west of Albert mines, parish of Hillsborough, Albert county. Collected by Mr. H. P. Brumell.

A gray felsite schist, through which was disseminated numerous small grains of iron-pyrites. Weight of sample, one pound.

It contained neither gold nor silver.

- 7.—From half a mile from Upper Salmon River, parish of Alma, Albert County. Examined for Mr. James Robertson.

A crushed sample of quartzose rock containing a small quantity of copper-pyrites. It was found to contain :

Gold.....none.
Silver.....0'175 of an ounce to the ton of 2,000 lbs.

- 8.—From a vein on Hammond River, King's county. Examined for Gold and silver assays, *cont.*
Mr. James Robertson.

A crushed sample of quartzose rock containing a small quantity of galena and copper-pyrites. Assays gave : Province of New Brunswick, *cont.*

Gold..... none.
Silver..... 1.692 ounce to the ton of 2,000 lbs.

- 9.—From L'Etete, Charlotte county.

An association of white sub-translucent quartz with a small quantity of dark grayish-green diorite, carrying a somewhat large amount of iron-pyrites. Weight of sample, one pound nine ounces.

It contained :

Gold trace.
Silver..... none.

- 10.—From Nigadoo River, parish of Beresford, Gloucester county.

An association of white opaque quartz with a light grayish-green to dark gray chloritic schist, carrying small quantities of iron-pyrites and zinc-blende. Assays gave :

Gold trace.
Silver..... 0.700 of an ounce to the ton of 2,000 lbs.

- 11.—From Northumberland county. Examined for Mr. J. J. Miller.

An association of white sub-translucent quartz, with small quantities of dark gray chloritic schist, carrying small quantities of iron-pyrites. Weight of sample, eleven ounces. It was found to contain :

Gold trace.
Silver..... none.

PROVINCE OF QUEBEC.

- 12.—From the south-west half of lots four and five of the eighth range of the township of Calumet, Pontiac county. Examined for Mr. John Shea.

An intimate association of quartz, felspar and mica with, here and there, a few small crystals of garnet, through which was disseminated large quantities of iron-pyrites. Weight of sample, seventeen pounds two ounces. Assays showed it to contain :

Gold trace.
Silver..... 1.108 ounce to the ton of 2,000 lbs.

- 13.—From the Shipshaw River, Chicoutimi county. Collected by Mr. Walter McOuat.

Gold and
silver assays,
cont.
Province of
Quebec, cont.

An association of a white, somewhat coarsely crystalline limestone with small quantities of a dark greenish-gray felspathic rock, carrying some zinc-blende and galena. The metallic sulphides constituted, approximately, twenty-one per cent, by weight, of the whole, and contained:

Gold..... none.
Silver..... 0.729 of an ounce to the ton of 2,000 lbs.

- 14.—This and the following specimen, is from the Suffield mine, lot three of the eleventh range of the township of Ascot, Sherbrooke county. They were examined for Mr. C. King.

A white, fine grained, quartzo-felspathic rock, through which was disseminated numerous fine particles of iron-pyrites, copper-pyrites and zinc-blende. Weight of sample, one pound thirteen ounces. Assays gave:

Gold..... trace.
Silver..... 1.575 ounce to the ton of 2,000 lbs.

- 15.—An association of white sub-translucent quartz with small quantities of white limestone and grayish-green chloritic schist, through which was disseminated small quantities of iron-pyrites, zinc-blende, copper-pyrites and galena. Weight of sample, two pounds five ounces. It was found to contain:

Gold trace.
Silver 20.475 ounces to the ton of 2,000 lbs.

- 16.—Tailings from gold washings on the Rivière du Loup, Beauce county.

The material consisted of a fine to coarse sand, composed of grains and crystals of magnetite and iron-pyrites, rounded grains of limonite and grains of quartz, felspar and garnet. Weight of sample, one pound nine ounces. Assays showed it to contain:

Gold..... 5.454 ounces to the ton of 2,000 lbs.
Silver..... 0.379 of an ounce " "

It was also examined for platinum and with negative results.

- 17.—From a so-called gold mine at a place called "La Barrière," in the unsurveyed portion of the township of Courcelles, Berthier county. Collected by Mr. N. J. Giroux.

A white, coarsely crystalline quartz associated with small quantities of epidote and serpentine. Weight of sample, two pounds eleven ounces. Assays gave:

Gold..... trace.
Silver..... none.

- 18.—From the same locality as the preceding specimen. Presented to Mr. Giroux by Mr. J. Obalski. Gold and silver assays, *cont.*

An association of a white, coarsely crystalline quartz, with small quantities of a salmon-coloured felspar. It was, in parts, stained with hydrated peroxide of iron. Weight of sample, five ounces. Province of Quebec, *cont.*
It contained :

Gold..... trace.
Silver..... none.

PROVINCE OF ONTARIO.

- 19.—From the twenty-fourth lot of the seventh concession of the township of Bastard, Leeds county. Examined for Mr. Arvin Brown.

An intimate mixture of carbonate and sulphate of lead with small quantities of undecomposed galena. Weight of sample, two ounces. It was found to contain :

Gold..... trace.
Silver 21·875 ounces to the ton of 2,000 lbs.

- 20.—From the sixteenth lot of the fourteenth concession of the township of Galway, Peterborough county. Examined for Mr. R. H. G. Chapman.

A fine crystalline, cavernous, to compact massive pyrite. Weight of sample, six ounces.

It contained neither gold nor silver.

- 21.—From Crooked Chenail Island, township of Ross, Renfrew county. Examined for Mr. W. Thomson.

A white sub-translucent cavernous quartz, carrying some pyrite and numerous fine scales of graphite. Weight of sample, one pound three ounces. Assays gave :

Gold..... trace.
Silver .. none.

- 22.—From lot thirty-four in the south-west concession of the Frontenac Road, in the township of Clarendon, Frontenac county. Examined for Mr. William White.

An association of quartz and a gneissoid rock, carrying small quantities of pyrite and pyrrhotite. It was, in parts, coated with hydrated peroxide of iron. Weight of sample, one pound seven ounces.

It contained neither gold nor silver.

Gold and
silver assays,
cont.
Province of
Ontario, cont.

- 23.—From the Kaladar or Golden Fleece mine, lot twenty-five of the sixth concession of the township of Kaladar, Addington county. Collected by Dr. A. R. C. Selwyn.

Hornblendic gneiss carrying small quantities of pyrite. Weight of sample, two pounds twelve ounces. Assays showed it to contain :

Gold..... trace.
Silver..... 0.233 of an ounce to the ton of 2,000 lbs.

- 24.—From the twenty-sixth lot of the ninth concession of the township of Clarendon, Frontenac county. Examined for Mr. Jonathan Muldoon.

White sub-translucent quartz, carrying a somewhat large quantity of coarsely crystalline galena. The specimen was more or less thickly coated with earthy carbonate of lead. Weight of sample, two and a half pounds. The galena freed from gangue was found to contain :

Gold..... none.
Silver..... 59.062 ounces to the ton of 2,000 lbs.

- 25.—From the thirty-second lot of the eleventh concession of the township of Clarendon, Frontenac county. Examined for Mr. James Warner.

A white sub-translucent quartz, in parts stained with ferric hydrate, carrying a small quantity of pyrrhotite. Weight of sample, two pounds ten ounces.

It contained neither gold nor silver.

- 26.—From lot forty-two of the north-east concession of the township of Clarendon, Frontenac county. Examined for Mr. Jonathan Muldoon.

Weathered pyrrhotite. Weight of sample, seven pounds two ounces.

It contained neither gold nor silver.

- 27.—From the south-half of the eighth lot of the second concession of the township of Ross, Renfrew county. Examined for Mr. E. Tuffy.

The material, some thirteen fragments, consisted of a quartzofelspathic gneissoid rock with a somewhat coarsely crystalline limestone and a little pyroxene. Numerous small crystals of garnet and some minute specks of pyrrhotite were disseminated through certain of the fragments. Weight of sample, eleven pounds.

It contained neither gold nor silver.

- 28.—From the twelfth lot of the eighth concession of the township of Barrie, Frontenac county. Examined for Mr. Jonathan Muldoon. Gold and silver assays, cont.

A coarsely crystalline galena in a gangue of white crystalline limestone. The latter constituted but a small proportion, by weight, of the whole. Weight of sample, five pounds twelve ounces. Assays showed the galena, free from gangue, to contain :

Gold.....trace.
Silver.....137.083 ounces to the ton of 2,000 lbs.

Province of Ontario, cont.

- 29.—From the ninth lot of the eighth concession of the township of Barrie, Frontenac county. The vein is said to be from five to eight or nine feet wide and to traverse, in addition to this lot, also lots ten and eleven as well as, as may be seen from the preceding assay, lot twelve of this concession. Examined for Mr. W. J. Morris.

A coarsely crystalline galena with, here and there, a few specks of pyrite, in a gangue of white crystalline limestone. The latter constituted but a small proportion, by weight, of the whole. Weight of sample, five ounces. The galena, freed from all gangue, was found to contain :

Gold.....None.
Silver.....119.583 ounces to the ton of 2,000 lbs.

- 30.—From a vein of quartz, fifty feet wide, on the west side of Little Clear Lake, two miles west of dam at outlet of Lake Wahnapiatae, district of Nipissing. This, and the four following specimens were collected by Dr. R. Bell.

An association of white sub-translucent, cavernous quartz with a small quantity of yellowish to reddish-gray dolomite, through which was disseminated a few grains of pyrite. The cavities in the quartz were lined with ferric hydrate. Weight of sample, fourteen ounces.

It contained neither gold nor silver.

- 31.—From a nine-inch vein on the east side of Waddell's Lake, district of Nipissing.

A white sub-translucent, cavernous quartz, the cavities of which were filled with ferric hydrate. Weight of sample, eight ounces.

Assays gave :

Gold.....trace.
Silver.....none.

Gold and
silver assays,
cont.
Province of
Ontario, cont.

- 32.—From vein No. 1 on mining location W. R. III., in township 40, south-east side of Lake Wahnapiatae, district of Nipissing. Property of Donald McLaren.

An association of white limestone, white sub-translucent quartz, and a reddish coloured granite—carrying large quantities of mispickel (which was more or less thickly incrustated with arsenolite) and small quantities of pyrite. Weight of sample, four ounces and a half. It contained:

Gold..... 0·117 of an ounce to the ton of 2,000 pounds.
Silver..... none.

- 33.—From vein No. 2 on mining location W. R. III.—same as that whence the preceding specimen was obtained.

An association of white crystalline limestone and white sub-translucent quartz, containing, here and there, a few grains of pyrite. Weight of sample, five ounces.

It contained neither gold nor silver.

- 34.—From location M. III., at southern extremity of Matagamishing Lake, a short distance north-east of Lake Wahnapiatae, district of Nipissing. Property of Donald McLaren.

A white sub-translucent quartz, more or less stained with ferric hydrate, carrying large quantities of pyrite. Weight of sample, seven ounces. It was found to contain:

Gold..... 1·167 ounce to the ton of 2,000 lbs.
Silver..... 0·233 of an ounce " "

- 35.—From the big gash vein of quartz on lot eleven of the fourth concession of the township of Creighton, district of Algoma. This, and the two following specimens were collected by Mr. A. E. Barlow.

A white sub-translucent quartz, in parts coated with ferric hydrate. Weight of sample, one pound.

It contained neither gold nor silver.

- 36.—From Ahn's opening on lot eleven of the fourth concession of the township of Creighton, district of Algoma.

An association of white sub-translucent quartz with small quantities of white ankerite and a greenish-white felspar. The specimen was, in parts, coated with ferric hydrate. Weight of sample, fifteen ounces.

It contained neither gold nor silver.

- 37.—From Gordon's opening on lot two of the fourth concession of the township of Fairbank, district of Algoma. Gold and silver assays, cont.

A white sub-translucent to opaque quartz, in parts coated with ferric hydrate. Weight of sample, ten ounces. Province of Ontario, cont.

It contained neither gold nor silver.

- 38.—From about two miles east of Algoma Mills, township of Long, district of Algoma. Examined for Mr. E. I. Skead.

An association of white sub-translucent to dark gray quartz with a little dark green chloritic schist, carrying small quantities of pyrite. Weight of sample, two pounds eight ounces.

It contained neither gold nor silver.

- 39.—From the centre of large vein of quartz, Ophir mine, lot twelve of the third concession of the township of Galbraith, district of Algoma. This, and the nine following specimens were collected by Dr. R. Bell.

White sub-translucent quartz carrying very large quantities of pyrite. Weight of sample, three pounds ten ounces. It was found to contain :

Gold	0.175 of an ounce to the ton of 2,000 lbs.
Silver	none.

- 40.—From the foot or north wall, west end of Ophir mine, lot twelve of the third concession of the township of Galbraith, district of Algoma.

A grayish-white sub-translucent quartz, in parts stained and coated with ferric hydrate, through which was disseminated a few grains of pyrite. Weight of sample, one pound ten ounces. Assays gave :

Gold	trace.
Silver	none.

- 41.—From the hanging or south wall, west end of Ophir mine, lot twelve of the third concession of the township of Galbraith, district of Algoma.

A white sub-translucent honeycombed quartz, the cavities of which were filled with ferric hydrate. It contained :

Gold	trace.
Silver	0.175 of an ounce to the ton of 2,000 lbs.

Gold and
silver assays,
cont.
Province of
Ontario, *cont.*

- 42.—From near the hanging wall, eastern opening of Ophir mine, lot twelve of the third concession of the township of Galbraith, district of Algoma.

An association of grayish-white to dark gray quartz with a small quantity of white calcite, carrying a somewhat large quantity of copper-pyrites and a few flakes of native gold. It was found to contain :

Gold.....0.583 of an ounce to the ton of 2,000 lbs.
Silver none.

- 43.—From No. 3 shaft, lot five of the fourth concession of the township of Denison, district of Algoma.

White sub-translucent quartz carrying small quantities of galena. Weight of sample, one pound eleven ounces. Assays gave :

Gold.....trace.
Silver 0.525 of an ounce to the ton of 2,000 lbs.

- 44.—An average of six samples of crushed material from the east half of the Ross location, three miles north of the northern township line of the township of Morgan, district of Algoma.

The material, consisting of more or less weathered copper and iron-pyrites, weighed six ounces.

It contained neither gold nor silver.

- 45.—From Simpson's mine, near Whitefish station on the line of the Canadian Pacific Railway, lot eleven of the second concession of the township of Graham, district of Algoma.

A coarse to fine powder, composed of iron-pyrites with some siliceous matter. Weight of sample, three ounces. It was found on assay to contain :

Gold.....0.350 of an ounce to the ton of 2,000 lbs.
Silver none.

- 46.—From Simon Obonsoing's mine, on the eighth lot of the third concession of the township of Moncrieff, district of Algoma.

A white sub-translucent, honeycombed quartz, the cavities of which were filled with ferric hydrate, through which was disseminated numerous small particles of pyrite. Weight of sample, one pound one ounce. It contained :

Gold trace.
Silver none.

- 47.—From near the line of the Canadian Pacific Railway, 480 $\frac{1}{4}$ miles west of Montreal, township of Hess, district of Algoma. Gold and silver assays, *cont.*

White crypto-crystalline quartz, stained and coated with ferric hydrate. Weight of sample, nine ounces. Assays gave: Province of Ontario, *cont.*

Gold.....trace.
Silver.....none.

- 48.—From the north-east corner of the township of Plummer, district of Algoma.

An association of white sub-translucent quartz with a little reddish-gray dolomite, carrying large quantities of chalcocite and a small amount of cuprite. It was found to contain:

Gold.....trace.
Silver.....none.

PROVINCE OF MANITOBA.

Province of
Manitoba.

- 49.—From the boring at Deloraine.

The material consisted of nodules of fine crystalline iron-pyrites which were met with, in clay, at a depth of eighteen hundred feet. Weight of sample, six ounces.

It contained neither gold nor silver.

- 50.—From lowest rapid on the L'Oiseau River. Received by Mr. J. B. Tyrrell from Mr. J. T. Little.

A dark gray quartz, stained and coated with ferric hydrate, carrying large quantities of pyrite. Weight of sample, two pounds seven ounces.

It contained neither gold nor silver.

NORTH-WEST TERRITORY.

- 51.—From the Mudjatick or Cariboo River, a tributary of the Churchill River, district of Saskatchewan. Collected by Mr. J. B. Tyrrell. North-west Territory.

White sub-translucent quartz, in parts stained with ferric hydrate, through which was disseminated numerous fine specks of pyrrhotite.

It contained neither gold nor silver.

- 52.—From the Barren Grounds, country near upper post, Great Fish River. Collected by Mr. Warburton Pike.

White sub-translucent quartz, stained with ferric hydrate, and carrying large quantities of pyrite. Weight of sample, ten ounces.

It contained neither gold nor silver.

Gold and
silver assays,
cont.

PROVINCE OF BRITISH COLUMBIA.

Of the following—

Specimens Nos. 53—56 are from the East Kootanie district.

" " 57—138 " West Kootanie district.*

" " 139—176 " Interior plateau region.

" " 177—191 " Coast Ranges and coast region.

(Specimens Nos. 62-70, 76-86, 90 and 95—138 were collected by Mr. E. D. Ingall : Nos. 148-170, by Dr. G. M. Dawson, and Nos. 171—173 by Mr. J. McEvoy.)

East Kootanie district.

53.—From slope of mountain south of Kinbasket Lake, Columbia River, East Kootanie district. Collected by Mr. R. G. McConnell.

White sub-translucent quartz, in parts stained with ferric hydrate, carrying large quantities of coarse crystalline galena.

The latter, freed from gangue, was found to contain :

Gold..... none.

Silver..... 26·250 ounces to the ton of 2,000 lbs.

54.—From the vicinity of Glacier House, on the line of the Canadian Pacific Railway, East Kootanie district. Collected by Dr. G. M. Dawson.

White sub-translucent quartz, in parts stained with ferric hydrate, through which was disseminated numerous small grains of pyrite. Weight of sample, one pound seven ounces. It contained :

Gold..... trace.

Silver..... none.

55.—From Vermont Creek, Middle Fork of the Spilimichine River, East Kootanie district. Examined for Mr. W. A. Jowett.

A fibrous jamesonite. Assays showed it to contain :

Gold.... trace.

Silver... 5·833 ounces to the ton of 2,000 lbs.

56.—From Carbonate Mountain, district of Golden, East Kootanie district. Examined for Mr. Walter Scott.

An association of malachite and azurite with intermixed ferric hydrate. Weight of sample, six ounces. It was found to contain :

Gold..... none.

Silver..... 0·292 of an ounce to the ton of 2,000 lbs.

* Of the mining centres beyond referred to as being in this district, the Hot Springs or Ainsworth camp is in 49° 44' N. Lat., 116° 55' W. Long. ; the Kaslo-Slocan mining camp in 49° 57' N. Lat., 117° 12' W. Long. and the Illecillewaet mines in 51° 0' N. Lat., 118° 0' W. Long.

- 57.—From Prairie Mountain, Bear Creek, Selkirk Range, West Kootanie district. Examined for Mr. J. J. Driscoll. Gold and silver assays, *cont.*

An association of white sub-translucent quartz with a small quantity of a dark gray talcose schist. The specimen, which was stained and coated with ferric hydrate, weighed two pounds five ounces. Assays gave :

Gold..... trace.
Silver none.

Province of British Columbia, *cont.*
West Kootanie district.

- 58.—From Goat River, Kootanie Lake, West Kootanie district.

It consisted of tetrahedrite disseminated through a gangue composed of white sub-translucent quartz and fine grained dolomite. The specimen, which was more or less coated with blue and green carbonate of copper and ferric hydrate, weighed one pound four ounces. It was found to contain :

Gold.... distinct trace.
Silver 28·437 ounces to the ton of 2,000 lbs.

- 59.—From about five miles from Trail Creek, east side of the Columbia River, West Kootanie district. Examined for Mr. J. O. Tretheway.

An association of a somewhat fine grained pyrrhotite with pyrite and a little chalcopryite, through which was disseminated small quantities of a quartzose gangue. Weight of sample, eight ounces.

It contained neither gold nor silver.

- 60.—From a ledge south of Kootanie River, close to the Columbia River, West Kootanie district. Examined for Mr. J. J. Driscoll.

An association of white sub-translucent quartz with a dark gray gneissoid rock and a little dark grayish-green chloritic schist, through which was disseminated small quantities of chalcopryite and a few specks of pyrite. The specimen, which was in parts coated with ferric hydrate and green carbonate of copper, weighed one pound fourteen ounces. It contained :

Gold.... trace.
Silver 0·467 of an ounce to the ton of 2,000 lbs.

- 61.—From a three-foot ledge situate four miles west of the cinnabar claims on Kamloops Lake, West Kootanie district. Examined for Mr. S. Macartney.

A somewhat coarsely crystalline grayish-white limestone, more or less thickly coated with ferric hydrate. Weight of sample, two pounds eight ounces. Assays showed it to contain :

Gold..... none.
Silver 1·341 ounce to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

West Koota-
nie district,
cont.

- 62.—This, and the following specimen, is from the Blue Bell claim, Illecillewaet mines, West Kootanie district.

A white sub-translucent quartz, in parts, thickly coated with ferric hydrate and green carbonate of copper, carrying large quantities of copper-pyrites. Weight of sample, thirteen ounces. It was found to contain :

Gold ..	none.
Silver...	11·608 ounces to the ton of 2,000 lbs.

- 63.—White sub-translucent quartz, in parts stained with ferric hydrate, carrying large quantities of coarsely crystalline galena. Assays gave :

Gold.....	none.
Silver.....	40·833 ounces to the ton of 2,000 lbs.

- 64.—From the Cariboo claim, Illecillewaet mines, West Kootanie district.

An association of white sub-translucent quartz with a grayish-white felsite, carrying small quantities of iron-pyrites. The specimen, which was in parts coated with ferric hydrate, weighed nine ounces. Assays showed it contain :

Gold.....	none.
Silver.....	0·223 of an ounce to the ton of 2,000 lbs.

- 65.—From the same claim as the last.

White sub-translucent quartz, carrying some coarsely crystalline galena, a little zinc-blende, and a few grains of pyrite. Weight of sample, five ounces. It contained :

Gold.....	none.
Silver.....	0·317 of an ounce to the ton of 2,000 lbs.

- 66.—From the Edinburgh claim, Illecillewaet mines, West Kootanie district.

A somewhat finely crystalline galena in a gangue of white sub-translucent quartz. The galena, freed from gangue, contained :

Gold.....	none.
Silver.....	39·375 ounces to the ton of 2,000 lbs.

- 67.—From the same claim as the preceding specimen.

A coarse crystalline galena, through which was disseminated a trifling amount of a gray quartzose rock. Weight of sample, one and a quarter ounce. It was found, on assay, to contain :

Gold.....	trace.
Silver.....	204·166 ounces to the ton of 2,000 lbs.

- 68.—From the Elizabeth claim, Illecillewaet mines, West Kootanie district. Gold and silver assays, *cont.*

The material, which was in a pulverulent form, was found to contain : Province of British Columbia, *cont.*

Gold..... none.
Silver..... 692·708 ounces to the ton of 2,000 lbs. West Kootanie district, *cont.*

- 69.—From the same claim as the preceding specimen.

A coarsely crystalline galena, in parts coated with ferric hydrate.

Weight of sample, seven ounces. It contained :

Gold none.
Silver..... 318·646 ounces to the ton of 2,000 lbs.

- 70.—Also from the Elizabeth claim.

A friable admixture of calcite, galena and pyrite. Weight of sample, two ounces. Assays gave :

Gold..... none.
Silver..... 149·479 ounces to the ton of 2,000 lbs.

- 71.—From the same claim as that just referred to.

An association of coarse to fine crystalline galena, through which was disseminated a small amount of quartzose gangue. It was found to contain :

Gold... none.
Silver..... 175·729 ounces to the ton of 2,000 lbs.

- 72.—Another specimen from this claim,

Consisting of a coarse crystalline galena, gave on assay :

Gold..... none.
Silver..... 109·375 ounces to the ton of 2,000 lbs.

- 73.—Also from the Elizabeth claim.

A more or less weathered, fine to coarse crystalline galena.

Weight of sample, eight ounces. Assays gave :

Gold..... trace.
Silver 142·916 ounces to the ton of 2,000 lbs.

- 74.—From the Scotia claim, Fish Creek, West Kootanie district.

A highly weathered rock matter, consisting of fragments of white and blackish-gray quartz with kaolin. The material, which was assayed on behalf of Mr. Walter Scott—

Contained neither gold nor silver.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

West Koota-
nie district,
cont.

- 75.—From Fish Creek, which flows into the north-east arm of Upper Arrow Lake, West Kootanie district.

A fine crystalline and fibrous form of galena, in a gangue of white sub-translucent quartz. Weight of sample, one ounce. It contained :

Gold..... none.
Silver..... 110·417 ounces to the ton of 2,000 lbs.

- 76.—From Fishburn's claim, Illecillewaet mines, West Kootanie district.

Zinc-blende, more or less thickly coated with ferric hydrate. It was found, on assay, to contain :

Gold..... none.
Silver... 5·833 ounces to the ton of 2,000 lbs.

- 77.—From the Gold Hill claim, Illecillewaet mines, West Kootanie district.

A coarsely crystalline galena in a gangue of finely crystalline white limestone. Weight of sample, one pound two ounces. The galena, freed from gangue, was found to contain :

Gold..... none.
Silver..... 18·958 ounces to the ton of 2,000 lbs.

- 78.—From the Herring-back claim, Illecillewaet mines, West Kootanie district.

Zinc-blende together with a little pyrite, in a gangue of fine crystalline dolomitic limestone.

It contained neither gold nor silver.

- 79.—Also from the Herring-back claim.

A fine-crystalline galena, in a quartzose gangue. Assays gave :

Gold..... none.
Silver..... 10·208 ounces to the ton of 2,000 lbs.

- 80.—From the Jumbo claim, Illecillewaet mines, West Kootanie district.

An association of white sub-translucent quartz with gray chloritic schist. Weight of sample, six ounces. It contained :

Gold..... none.
Silver..... 0·525 of an ounce to the ton of 2,000 lbs.

81.—From the same claim as the last.

A white opaque quartz, in parts stained with ferric hydrate, carrying a finely crystalline galena and some pyrite. Weight of sample, twelve ounces. Assays showed it to contain :

Gold..... none.
Silver..... 12·075 ounces to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

West Koota-
nie district,
cont.

82.—From the Lanark claim, Illecillewaet mines, West Kootanie district.

A coarsely crystalline galena, in parts coated with ferric hydrate. Weight of sample, nine ounces. It was found to contain :

Gold..... none.
Silver..... 57·604 ounces to the ton of 2,000 lbs.

83.—From the same claim as the preceding specimen.

A coarsely crystalline galena in a gangue of white sub-translucent quartz. Weight of sample, two ounces. The galena, freed from gangue, was found to contain :

Gold..... none.
Silver..... 73·646 ounces to the ton of 2,000 lbs.

84.—Also from the Lanark claim.

A white sub-translucent quartz, stained with ferric hydrate, carrying small quantities of coarsely crystalline galena. Weight of sample, seven ounces. Assays gave :

Gold none.
Silver..... 6·533 ounces to the ton of 2,000 lbs.

85.—From the Maple Leaf claim, Illecillewaet mines, West Kootanie district.

Limestone, in parts coated with ferric hydrate, carrying small quantities of coarsely crystalline galena. Weight of sample, fourteen ounces. It contained :

Gold..... none.
Silver..... 8·021 ounces to the ton of 2,000 lbs.

86.—From the Sanquhar claim, Illecillewaet mines, West Kootanie district.

An association of coarsely crystalline limestone with a little white sub-translucent quartz, carrying small quantities of coarsely crystalline galena. Weight of sample, one pound one ounce. Assays showed it to contain :

Gold..... none.
Silver..... 4·842 ounces to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

West Koota-
nie district,
cont.

87.—From the same claim as the preceding specimen.

A coarsely crystalline galena, coated with ferric hydrate.

Weight of sample, five ounces. Assays gave :

Gold..... none.

Silver..... 106·854 ounces to the ton of 2,000 lbs.

88.—Also from the Sanguhar claim.

A coarsely crystalline galena, in a gangue of coarse crystal-
line limestone. Weight of sample, six ounces. It was found to
contain :

Gold..... none.

Silver..... 14·817 ounces to the ton of 2,000 lbs.

89.—From the Silver Bow claim, Illecillewaet mines, West Kootanie
district. Examined for Mr. Walter Scott.

Bornite, through which was disseminated a little white sub-
translucent quartz. The specimen, which was more or less coated
with green carbonate of copper, weighed eight ounces. On assay
it was found to contain :

Gold..... very distinct trace.

Silver..... 19·075 ounces to the ton of 2,000 lbs.

90.—From the Iron Schist Belt claim, Illecillewaet mines, West
Kootanie district.

A white sub-translucent quartz, carrying a somewhat large
amount of hematite. Weight of sample, one pound.

It contained neither gold nor silver.

91.—From the Illecillewaet, West Kootanie district.

An association of white sub-translucent quartz with small quan-
tities of pale greenish-white euphyllite. The specimen, which
was, in parts, coated with ferric hydrate, weighed seven ounces.

It contained neither gold nor silver.

92.—From the Goat Cave claim, Illecillewaet mines, West Kootanie
district.

White sub-translucent quartz carrying a somewhat large amount
of galena. The specimen, which was in parts coated with ferric
hydrate, weighed eleven ounces. It contained :

Gold..... none.

Silver..... 158·227 ounces to the ton of 2,000 lbs.

93.—From the same claim as the preceding specimen.

An association of white sub-translucent quartz with a little chloritic schist, carrying a somewhat large amount of galena. Weight of sample, two ounces. Assays gave :

Gold none.
Silver..... 216·562 ounces to the ton of 2,000 lbs.

Gold and silver assays, cont.

Province of British Columbia, cont.

West Kootanie district, cont.

94.—From the Sutton claim, North Fork of the Illecillewaet River, West Kootanie district.

An association of coarse crystalline pyrite and fine grained galena. Weight of sample, six ounces. It was found to contain :

Gold..... none.
Silver..... 24·062 ounces to the ton of 2,000 lbs.

95.—From the Dictator claim, Hot Springs or Ainsworth camp, West Kootanie district.

An association of a fine crystalline grayish-white dolomitic limestone with some mica-schist, through which was disseminated small quantities of a coarsely crystalline galena. Weight of sample, one pound two ounces. The galena, freed from gangue, was found to contain :

Gold..... none.
Silver..... 137·083 ounces to the ton of 2,000 lbs.

96.—From the Kraeo claim, Hot Springs or Ainsworth camp, West Kootanie district.

A coarsely crystalline galena with a little zinc-blende, in a gangue of fine crystalline, grayish-white dolomitic limestone. Assays gave :

Gold none.
Silver 29·896 ounces to the ton of 2,000 lbs.

97.—From the same claim as the preceding specimen.

Consisted of zinc-blende in a gangue of finely crystalline dolomitic limestone. The zinc-blende, freed from gangue, was found to contain :

Gold..... none.
Silver..... 10·208 ounces to the ton of 2,000 lbs.

98.—From the Neosho claim, Hot Springs or Ainsworth camp, West Kootanie district.

Weathered rock matter. Weight of sample, five ounces. It was found to contain :

Gold..... none.
Silver 178·675 ounces to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*
West Koota-
nie district,
cont.

- 99.—From the Skyline claim, Hot Springs or Ainsworth camp, West Kootanie district.

A grayish-white crypto-crystalline quartz, carrying small quantities of zinc-blende and coarsely crystalline galena. Weight of sample, two pounds seven ounces. It contained :

Gold distinct trace.
Silver 68·425 ounces to the ton of 2,000 lbs.

- 100.—From the Lady of the Lake claim, Hot Springs or Ainsworth camp, West Kootanie district.

A somewhat coarsely crystalline galena, distributed through a calcareous gangue. The galena, freed from gangue, contained :

Gold none.
Silver 164·792 ounces to the ton of 2,000 lbs.

- 101.—From the Beaver claim, Kaslo-Slocan mining camp, West Kootanie district.

A weathered limestone, in parts stained with blue and green carbonate of copper. Weight of sample, thirteen ounces. Assays showed it to contain :

Gold none.
Silver 12·250 ounces to the ton of 2,000 lbs.

- 102.—From the Best claim, Kaslo-Slocan mining camp, West Kootanie district.

An association of white, opaque quartz with a little white limestone, carrying small quantities of galena and iron-pyrites. Weight of sample, five ounces. It contained :

Gold none.
Silver 107·858 ounces to the ton of 2,000 lbs.

- 103.—From the same claim as the preceding specimen.

A fine crystalline and massive galena with a little pyrite and zinc-blende, in a gangue composed of white opaque quartz and a little coarsely crystalline limestone. The metallic sulphides, freed from gangue, contained :

Gold none.
Silver 148·750 ounces to the ton of 2,000 lbs.

- 104.—Also from the Best claim.

An exteriorly weathered specimen of coarsely crystalline galena. Weight of sample, one pound twelve ounces. Assays gave :

Gold none.
Silver 521·354 ounces to the ton of 2,000 lbs.

- 105.—From the Blue Bird claim, Kaslo-Slocan mining camp, West Kootanie district. Gold and silver assays, *cont.*

A coarsely crystalline galena, so-called curved-face ore. It was found to contain : Province of British Columbia, *cont.*

Gold... none.

Silver..... 146·562 ounces to the ton of 2,000 lbs.

West Kootanie district, *cont.*

- 106.—From the same claim as the preceding specimen.

A coarsely crystalline galena, more or less thickly coated with yellow, earthy carbonate of lead. A specimen of the so-called curved-face ore. It contained :

Gold..... none.

Silver..... 155·312 ounces to the ton of 2,000 lbs.

- 107.—Also from the Blue Bird claim.

A coarsely crystalline galena, so-called ribbed ore. Assays showed it to contain :

Gold..... none.

Silver..... 150·208 ounces to the ton of 2,000 lbs.

- 108.—Another specimen from this claim—

Consisting of a somewhat coarsely crystalline galena—the so-called spangle ore, was found to contain :

Gold..... none.

Silver 182·292 ounces to the ton of 2,000 lbs.

- 109.—From the Dardanelles claim, Kaslo-Slocan mining camp, West Kootanie district.

A very fine crystalline galena, traversed by a thin seam of white quartz and containing, in parts, a few small aggregations of pyrrargyrite. The galena, freed from gangue, was found to contain :

Gold..... none.

Silver..... 360·208 ounces to the ton of 2,000 lbs.

- 110.—From the Florence claim, Kaslo-Slocan mining camp, West Kootanie district.

A reddish-yellow ochre. Assays of this gave :

Gold..... none.

Silver..... 0·357 of an ounce to the ton of 2,000 lbs.

- 111.—From the Freddie Lee claim, Kaslo-Slocan mining camp, West Kootanie district.

A coarsely crystalline galena. It contained :

Gold..... none.

Silver..... 120·312 ounces to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

West Koota-
nie district,
cont.

112.—From the same claim as the preceding specimen.

A somewhat coarsely crystalline galena, so-called spangle ore.

Assays gave :

Gold.....	none.
Silver.....	153.125 ounces to the ton of 2,000 lbs.

113.—Also from the Freddie Lee claim.

A red ochreous material with intermixed fragment of galena coated with ferric hydrate. It was found on assay to contain :

Gold.....	none.
Silver.	136.354 ounces to the ton of 2,000 lbs.

114.—From the Great Western claim, Kaslo-Slocan mining camp, West Kootanie district.

A somewhat coarsely crystalline galena, so-called spangle ore.

It contained :

Gold.....	none.
Silver.....	341.146 ounces to the ton of 2,000 lbs.

115.—From the Ibex claim, Kaslo-Slocan mining camp, West Kootanie district.

A somewhat finely crystalline galena, in parts stained with ferric hydrate. Assays showed it to contain :

Gold..	none.
Silver.....	79.479 ounces to the ton of 2,000 lbs.

116.—From the same claim as the preceding specimen.

An association of zinc-blende, with a little coarsely crystalline galena. It contained :

Gold.....	none.
Silver.....	26.250 ounces to the ton of 2,000 lbs.

117.—From the Lucky Jim claim, Kaslo-Slocan mining camp, West Kootanie district.

Coarsely crystalline galena in association with a little finely crystalline white limestone. The galena, freed from gangue, was found to contain :

Gold	none.
Silver.....	91.875 ounces to the ton of 2,000 lbs.

118.—From the Monte Cristo claim, Kaslo-Slocan mining camp, West Kootanie district.

A finely crystalline galena. Assays gave :

Gold.....	none.
Silver.....	63.437 ounces to the ton of 2,000 lbs.

119.—From the Montezuma claim, Kaslo-Slocan mining camp, West Kootanie district. Gold and silver assays, *cont.*

A yellow, ochreous earth. It was found to contain :

Gold..... none.
Silver..... 20'417 ounces to the ton of 2,000 lbs.

Province of British Columbia, *cont.*
West Kootanie district, *cont.*

120.—From the same claim as the preceding specimen.

A somewhat coarsely crystalline galena, in parts coated with ferric hydrate and earthy carbonate of lead. Assays showed it to contain :

Gold..... none.
Silver 102'083 ounces to the ton of 2,000 lbs.

121.—Also from the Montezuma claim.

A somewhat coarsely crystalline galena, so-called spangle ore.

It contained :

Gold..... none.
Silver..... 136'354 ounces to the ton of 2,000 lbs.

122.—From the Payne claim, Kaslo-Slocan mining camp, West Kootanie district.

A coarsely crystalline galena. It was found to contain :

Gold..... none.
Silver..... 154'583 ounces to the ton of 2,000 lbs.

123.—From the same claim as the preceding specimen.

A finely crystalline galena. It contained :

Gold..... none.
Silver..... 186'667 ounces to the ton of 2,000 lbs.

124.—Also from the Payne claim.

A somewhat coarsely crystalline galena, locally known as spangle ore. Assays showed it to contain :

Gold..... none.
Silver..... 172'083 ounces to the ton of 2,000 lbs.

125.—Another specimen from this claim—

Consisting of a coarsely crystalline galena, in parts stained and coated with ferric hydrate, was found to contain :

Gold..... none.
Silver.. . . . 120'312 ounces to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

West Koota-
nie district,
cont.

- 126.—From the Silver Tip claim, Kaslo-Slocan mining camp, West Kootanie district.

A brownish-black zinc-blende, in a gangue of somewhat coarsely crystalline limestone. Assays gave :

Gold none.
Silver..... 73·267 ounces to the ton of 2,000 lbs.

- 127.—From the Slocan Boy claim, Kaslo-Slocan mining camp, West Kootanie district.

A finely crystalline galena. It was found, on assay, to contain :

Gold none.
Silver..... 123·229 ounces to the ton of 2,000 lbs.

- 128.—From the Slocan Star claim, Kaslo-Slocan mining camp, West Kootanie district.

An association of a somewhat finely crystalline galena with small quantities of iron-pyrites. It contained :

Gold none.
Silver..... 73·646 ounces to the ton of 2,000 lbs.

- 129.—From the Solo claim, Kaslo-Slocan mining camp, West Kootanie district.

A somewhat coarsely crystalline galena in a gangue of dolomitic limestone. The galena, freed from the gangue, was found to contain :

Gold..... none.
Silver..... 38·612 ounces to the ton of 2,000 lbs.

- 130.—From the Triangle claim, Kaslo-Slocan mining camp, West Kootanie district.

A finely crystalline galena, more or less thickly coated with ferric hydrate. Assays gave :

Gold..... none.
Silver 136·354 ounces to the ton of 2,000 lbs.

- 131.—From the same claim as the preceding specimen.

A coarsely crystalline galena, more or less thickly coated with ferric hydrate. It was found, on assay, to contain :

Gold none.
Silver..... 107·184 ounces to the ton of 2,000 lbs.

- 132.—From the Washington claim, Kaslo-Slocan mining camp, West Kootanie district.

A finely crystalline galena. It contained :

Gold..... none.
Silver..... 110·104 ounces to the ton of 2,000 lbs.

133.—From the same claim as the preceding specimen.

A coarsely crystalline galena. Assays gave :

Gold..... none.
Silver 126·146 ounces to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

West Koota-
nie district,
cont.

134.—From the Wellington claim, Kaslo-Slocan mining camp, West Kootanie district.

An association of limestone and chloritic-schist, carrying small quantities of galena. The latter, freed from gangue, was found to contain :

Gold..... none.
Silver..... 166·250 ounces to the ton of 2,000 lbs.

135.—Also from the Wellington claim.

A yellowish-brown earthy matter. Assays showed it to contain :

Gold trace.
Silver 1630·416 ounces to the ton of 2,000 lbs.

136.—From the White Heather claim, Kaslo-Slocan mining camp, West Kootanie district.

A coarsely crystalline galena together with a little copper-pyrites, in a gangue of weathered rock. The galena, freed from gangue, was found to contain :

Gold..... none.
Silver..... 48·854 ounces to the ton of 2,000 lbs.

137.—From the Yosemite claim, Kaslo-Slocan mining camp, West Kootanie district.

A coarsely crystalline galena in association with a little pyrite. It was found, on assay, to contain :

Gold..... none.
Silver 146·562 ounces to the ton of 2,000 lbs.

138.—From the Okanagan claim, Kaslo-Slocan mining camp, West Kootanie district.

A compact galena in a gangue of white sub-translucent quartz. Assays gave :

Gold..... trace.
Silver..... 116·783 ounces to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

Interior pla-
teau region.

- 139.—From an outcrop, about seven miles from Kamloops, Interior plateau region. Examined for Mr. J. W. Mackay.

It consisted of pyrite and a ferriferous zinc-blende in a gangue of white quartz. Weight of sample, three ounces and a half. It was found to contain :

Gold..... none.

Silver..... 7.291 ounces to the ton of 2,000 lbs.

- 140.—From Mosquito Flat, North Thompson River, about sixty miles from Kamloops, Interior plateau region. Examined for Mr. J. W. Mackay.

An association of yellowish-brown zinc-blende, with very small quantities of galena. The specimen, which was more or less stained and coated with ferric hydrate, contained :

Gold..... none.

Silver..... 11.666 ounces to the ton of 2,000 lbs.

- 141.—From the same locality as the preceding specimen, but from a different lode. Examined for Mr. J. W. Mackay.

Consisted of galena and zinc-blende in a gangue of quartz. The specimen, which weighed fifteen ounces, was more or less stained and coated with ferric hydrate. Assays gave :

Gold none.

Silver..... 48.125 ounces to the ton of 2,000 lbs.

- 142.—From the Foster mine, Thompson siding, on the line of the Canadian Pacific Railway, Interior plateau region.

The material, which was taken from a depth of ten feet, consisted of a fine crystalline magnetite together with a small amount of pyrrhotite, in a gangue of fine crystalline limestone, with a little serpentine. Weight of sample, one pound four ounces.

It contained neither gold nor silver.

- 143.—Also from the Foster mine, but taken from a greater depth, namely twenty feet.

The material, which consisted of numerous fragments, was composed of a fine crystalline magnetite and a coarse crystalline pyrite in a gangue of white sub-translucent quartz associated with a dark yellowish-green chloritic schist and white calcite. Weight of sample, three pounds one ounce.

It contained neither gold nor silver.

144.—From near Hope, Fraser River, Interior plateau region.

An intimate association of white quartz and felspar, carrying small quantities of copper-pyrites. Assays gave :

Gold.....none.

Silver.....0.758 of an ounce to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

Interior pla-
teau region,
cont.

145.—From Siwash Creek, Okanagan Lake, Interior plateau region.

Examined for Mr. G. DeWolf.

A white opaque quartz, traversed by bands of a dark gray quartzo-felsphatic rock, through which was disseminated numerous small crystals of pyrite. The specimen, which was more or less thickly coated with ferric hydrate, weighed one pound twelve ounces.

It contained neither gold nor silver.

146.—From the Sh-ha-ha-nih Indian Reserve, Lower Nicola River, Interior plateau region. This, and the following specimen, was examined for Mr. J. W. Mackay.

A coarse crystalline limestone, stained and coated with ferric hydrate, through which was disseminated a few particles of pyrite. Weight of sample, two pounds nine ounces. It contained :

Gold.....trace.

Silver.....none.

147.—From the claim of Frank Allingham on the right bank of the North Thompson River, thirty miles above the mouth of the Clearwater River, Interior plateau region.

An association of white sub-translucent quartz with white crystalline dolomite carrying small quantities of tetrahedrite and pyrite. Weight of sample, two pounds six ounces. Assays gave :

Gold.....trace

Silver.....1.925 ounce to the ton of 2,000 lbs.

148.—From the west side of the mouth of Botanie Creek, Thompson River, north of Lytton, Interior plateau region.

Consisted of a conglomerate made up, for the most part, of rounded and angular fragments of quartz cemented together by ferric hydrate. Weight of sample, ten ounces.

It contained neither gold nor silver

149.—From the west side of Hat Creek, about six miles from its entry into Bonaparte River, Interior plateau region.

A light to dark gray conglomerate. Weight of sample, ten ounces and a half.

It contained neither gold nor silver.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

Interior pla-
teau region,
cont.

- 150.—From a mile and a half south-west of Copper Creek, near Kamloops Lake, Interior plateau region.

A dark gray conglomerate. Weight of sample, six ounces. It was found to contain :

Gold.....	trace.
Silver.....	none.

- 151.—From one mile south of Lac à la Fourche, south of Nicola Lake, Interior plateau region.

A weathered conglomerate. Weight of sample, four ounces.

Assays gave :

Gold.....	trace.
Silver.....	none.

- 152.—From near longest lake in Garde Lafferty, north-west of and near Kamloops, Interior plateau region.

A highly weathered conglomerate. Weight of sample, twelve ounces.

It contained neither gold nor silver.

- 153.—From three miles west of McLean's Lake, west of Ashcroft, Interior plateau region.

A light to dark gray brecciated conglomerate. Weight of sample, fourteen ounces.

It contained neither gold nor silver.

- 154.—From the Upper Nicola, about two miles above Guichon's house, Interior plateau region.

Gray quartz, thickly coated with ferric hydrate. Weight of sample, one pound. It contained :

Gold.....	trace.
Silver.....	none.

- 155.—From head of Skull Creek, west side of the North Thompson River, Interior plateau region.

A white sub-translucent quartz, in association with small quantities of a very dark gray schist, in parts stained with ferric hydrate. Weight of sample, two pounds four ounces.

It contained neither gold nor silver.

- 156.—From near Pooytl Mountain, Interior plateau region.

An association of grayish-white granite with white opaque quartz, stained and coated with ferric hydrate. Weight of sample, one pound two ounces. Assays gave :

Gold.....	trace.
Silver.....	none.

157.—Also from near Pooytl Mountain.

White opaque to sub-translucent quartz, stained and coated with ferric hydrate. Weight of sample, thirteen ounces and a half. It contained :

Gold. trace.
Silver. none.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

Interior pla-
teau region,
cont.

158.—From mountains east of Lytton, Interior plateau region.

A highly weathered rock. Weight of sample, fourteen ounces.

It contained neither gold nor silver.

159.—From near Savona, on the line of the Canadian Pacific Railway, Interior plateau region.

White sub-translucent quartz, carrying very appreciable quantities of mispickel. Weight of sample, twelve ounces. It was found to contain :

Gold. trace.
Silver. none.

160.—From near Monashee mine, head of Cherry Creek, Shuswap River, Interior plateau region.

An association of white sub-translucent quartz, calcite, and dark green diorite, carrying large quantities of pyrrhotite and a small quantity of chalcopyrite. Weight of sample, two pounds twelve ounces. Assays gave :

Gold. trace.
Silver. none.

161.—From the Monashee mine, referred to in connection with the preceding specimen.

A grayish-white crypto-crystalline and dark gray compact quartz, in parts stained with ferric hydrate, through which was disseminated a few grains of pyrite. Weight of sample, one pound eleven ounces. It contained :

Gold. trace.
Silver. none.

162.—Also from the Monashee mine, taken from tunnel C.

White sub-translucent quartz, in parts coated with a yellowish-white ochreous material. Weight of sample, one pound twelve ounces. Assays showed it to contain :

Gold. distinct trace.
Silver. 0.350 of an ounce to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

Interior pla-
teau region,
cont.

- 163.—Another specimen from this mine, taken from tunnel E—

Consisting of white sub-translucent quartz, more or less stained and coated with ferric hydrate, carrying small quantities of chalcopryrite and galena, and which weighed three pounds and a half, was found to contain :

Gold.....	0.583 of an ounce to the ton of 2,000 lbs.
Silver.....	2.683 ounces " "

- 164.—From Watching Creek, a branch of Tranquille River, Interior plateau region.

White sub-translucent to opaque quartz, associated with small quantities of dark gray argillite. Weight of sample, one pound eleven ounces. Assays gave :

Gold.....	trace.
Silver.....	none.

- 165.—From Poison Hill, west side of the North Thompson River, Interior plateau region.

An association of white limestone with a small amount of white sub-translucent quartz, traversed by thin seams of pyrite, and in parts stained and coated with ferric hydrate. Weight of sample, one pound fifteen ounces.

It contained neither gold nor silver.

- 166.—From between Louis Creek and Barrière River, east side of the North Thompson River, Interior plateau region.

An association of white sub-translucent quartz with small quantities of dark gray schist. The specimen, which was in parts stained and coated with ferric hydrate, weighed one pound thirteen ounces. It contained :

Gold	trace.
Silver.....	none.

- 167.—From Moore's Creek, west side of Stump Lake, Interior plateau region.

A white felstone, in parts stained and coated with ferric hydrate. Weight of sample, one pound ten ounces.

It contained neither gold nor silver.

- 168.—From Chi-wowh Creek, Thompson River, opposite Spences Bridge, Interior plateau region.

A highly weathered rock. Weight of sample, one pound ten ounces. Assays showed it to contain :

Gold	trace.
Silver.....	none.

- 169.—From near Sin-soon-kum Lake, west side of the North Thompson River, Interior plateau region. Gold and silver assays, cont.

An association of white sub-translucent quartz with small quantities of green chloritic schist. The specimen, which was in parts stained and coated with ferric hydrate, weighed one pound eight ounces. It contained : Province of British Columbia, cont.
Interior plateau region, cont.

Gold..... trace.
Silver..... none.

- 170.—From Moore's Creek, about three miles north of Nicola Lake, Interior plateau region.

A white sub-translucent quartz stained with ferric hydrate. Weight of sample, one pound two ounces.

It contained neither gold nor silver.

- 171.—From near trail, half a mile west of mouth of Copper Creek, north side of Kamloops Lake, Interior plateau region.

A weathered granitoid rock. Weight of sample, one pound fourteen ounces.

It contained neither gold nor silver.

- 172.—From about two hundred yards south-west of the locality whence the preceding specimen was obtained.

A weathered conglomerate. Weight of sample, one pound six ounces.

It contained neither gold nor silver.

- 173.—From two miles west of Cinnemousun Narrows, Shuswap Lake, south side, Interior plateau region.

An association of a very fine granular pyrrhotite with small quantities of a gneissoid rock. The specimen, which was much weathered, weighed one pound fourteen ounces.

It contained neither gold nor silver.

- 174.—From the Tenderfoot claim, Copper Creek, north side of Kamloops Lake, Interior plateau region. Examined for Mr. F. Y. Christie.

An earthy admixture of ferric hydrate and blue and green carbonate of copper. Weight of sample, fourteen ounces. Assays gave :

Gold..... trace.
Silver..... 18.200 ounces to the ton of 2,000 lbs.

Gold and
silver assays,
cont.

Province of
British Colum-
bia, *cont.*

Interior pla-
teau region,
cont.

175.—From the same claim as the preceding specimen.

It consisted of bornite, thickly coated with ferric hydrate.
Weight of sample, an ounce and a quarter. It contained:

Gold	trace.
Silver	4375 ounces to the ton of 2,000 lbs.

176.—Also from the Tenderfoot claim.

An earthy admixture of green carbonate of copper and ferric hydrate. Weight of sample, one pound two ounces. Assays showed it to contain:

Gold	trace.
Silver	18500 ounces to the ton of 2,000 lbs.

Coast Ranges
and coast
region.

177.—This, and the two following specimens are from township seven-
teen, New Westminster district, Coast Ranges and coast region.

A fine granular quartz, through which was disseminated some-
what large quantities of pyrrhotite, iron-pyrites and copper-
pyrites. Weight of sample, two pounds three ounces. Assays
gave:

Gold	trace.
Silver	none.

178.—White and grayish-white crypto-crystalline quartz, through
which was disseminated small quantities of pyrrhotite. Weight
of sample, one pound. It contained:

Gold	trace.
Silver	none.

179.—A fine granular quartz, carrying very large quantities of pyrr-
hotite, iron-pyrites and copper-pyrites. Weight of sample,
thirteen ounces. It was found to contain:

Gold	distinct trace.
Silver	none.

180.—From Spuzzum Creek, west side of Fraser River, between Yale
and Suspension Bridge, Coast Ranges and coast region.

An association of white sub-translucent to opaque quartz, with
a small quantity of green chloritic schist. The specimen, which
was more or less stained and coated with ferric hydrate, weighed
four pounds five ounces.

It contained neither gold nor silver.

- 181.—From the Union Bar mine, near Hope station, on the line of the Canadian Pacific Railway, Coast Ranges and coast region. Gold and silver assays, *cont.*
 Examined for Mr. J. W. Mackay. Province of British Columbia, *cont.*
 Bluish-white to white opaque quartz, traversed by fine seams of copper-pyrites. The specimen, which was in parts coated with ferric hydrate, weighed two pounds three ounces. Assays gave : Coast Ranges and coast region, *cont.*
- | | |
|-------------|---------------------------------------|
| Gold | trace. |
| Silver..... | 1.167 ounces to the ton of 2,000 lbs. |
- 182.—From Big Cañon, Fraser River, Coast Ranges and coast region. Examined for Mr. J. W. Mackay.
 A coarse crystalline limestone, carrying large quantities of galena. Weight of sample, three ounces and a half. It contained :
- | | |
|-------------|---------------------------------------|
| Gold..... | none. |
| Silver..... | 1.458 ounces to the ton of 2,000 lbs. |
- 183.—From eight miles north of Burrard Inlet, Coast Ranges and coast region. Examined for Mr. H. Abbott.
 Dark brown sphalerite. Weight of sample, two ounces.
 It contained neither gold nor silver.
- 184.—From the head of Eckstall Inlet, south of Port Essington, Skeena River, Coast Ranges and coast region.
 A crystalline granular, massive, iron-pyrites, through which was disseminated a trifling amount of sphalerite. Weight of sample, ten ounces. Assays showed it to contain :
- | | |
|------------|--|
| Gold..... | trace. |
| Silver.... | 0.350 of an ounce to the ton of 2,000 lbs. |
- This material is said to constitute, at the locality in question, a vein fifteen feet wide, nearly vertical, running in a north-easterly direction from the shore and traceable for nearly a mile.
- 185.—From Jarvis Inlet, Coast Ranges and coast region. Examined for Mr. A. A. Davidson.
 An association of white sub-translucent quartz with small quantities of dark greenish-gray chloritic schist, carrying a little copper-pyrites. Assays gave :
- | | |
|-------------|--|
| Gold..... | trace. |
| Silver..... | 0.583 of an ounce to the ton of 2,000 lbs. |
- 186.—From near the head of Barclay Sound, Vancouver Island, Coast Ranges and coast region.
 A compact massive pyrrhotite. Weight of sample, two ounces. It contained :
- | | |
|-------------|--|
| Gold..... | trace. |
| Silver..... | 0.233 of an ounce to the ton of 2,000 lbs. |

Gold and
silver assays,
cont.

Province of
British Col-
umbia, *cont.*

Coast Ranges
and coast
region, *cont.*

- 187.—From Dean's Channel, twenty-five miles up the Setskon or Salmon River, Coast Ranges and coast region. This, and the two following specimens were examined for Mr. P. Jacobsen.

An association of quartz with small quantities of a grayish quartzo-felspathic rock, carrying small quantities of copper-pyrites. The specimen, which was more or less stained with ferric hydrate, weighed seven ounces. It was found, on assay, to contain :

Gold..... trace.
Silver..... 0.292 of an ounce to the ton of 2,000 lbs.

- 188.—From Burke Channel, King Island, Coast Ranges and coast region.

White, sub-translucent quartz, stained with ferric hydrate and green carbonate of copper. Weight of sample, seven ounces.

It contained neither gold nor silver.

- 189.—From Bentinck Arm, Coast Ranges and coast region.

White, sub-translucent quartz, carrying bornite and copper-pyrites. Assays showed it to contain :

Gold..... trace.
Silver.... 3.646 ounces to the ton of 2,000 lbs.

- 190.—From the east side of Cortez Island, Coast Ranges and coast region. Examined for Mr. W. H. Robertson.

An intimate association of serpentine, limestone, quartz, and felspar, with an occasional crystal of garnet, and here and there a little copper-pyrites. The specimen, which was in parts stained and coated with ferric hydrate and green carbonate of copper, weighed four ounces. It contained :

Gold..... trace.
Silver.... 1.167 ounce to the ton of 2,000 lbs.

- 191.—From Texada Island, Coast Ranges and coast region. Examined for Mr. John Campbell.

A brownish-yellow to reddish-brown, more or less vesicular, limonite, through which was disseminated small quantities of unaltered pyrite. Weight of sample, one pound six ounces.

It contained neither gold nor silver.

NATURAL WATERS.

Water from
boring at
Deloraine
(1,855 feet),
Man.

- 1.—Water from the boring at Deloraine, province of Manitoba. Taken at a depth of 1,855 feet. Collected, July, 1892.

At the time of examination it contained a small amount of suspended matter; this was removed by filtration. The filtered

water was colourless and odourless, and tasted mildly saline. Re- Natural
 action, neutral, when evaporated to a small volume, however, it waters, cont.
 becomes distinctly alkaline. Its specific gravity, at 15.5° C., was Water from
 found to be 1.0050. Boiling produced a slight precipitate con- boring at
 sisting of carbonate of lime with a little carbonate of magnesia. Deloraine
 (1,855 feet),
 Man., cont.

Agreeably with the results of an analysis, conducted by Mr.
 Wait, 1,000 parts, by weight, of the filtered water, at 15.5° C.,
 contained :

Potassa	0.0140
Soda.....	3.0611
Lime...	0.0219
Magnesia.....	0.0159
Chlorine.....	2.6803
Sulphuric acid.....	0.2258
Carbonic acid.....	0.9284
Less oxygen equivalent to chlorine	6.9474
	6.3434

The foregoing acids and bases may reasonably be assumed to
 be present in the water in the following state of combination :

(Carbonates calculated as anhydrous bi-carbonates, and the salts without their
 water of crystallisation.)

Chloride of potassium	0.0222
“ sodium.....	4.3995
Sulphate of soda.....	0.4008
Bi-carbonate of soda.....	1.3420
“ lime.....	0.0563
“ magnesia.....	0.0509
	6.2717
Carbonic acid, free.....	0.0717
	6.3434

An imperial gallon of the water, at the above-mentioned tem-
 perature, would contain :

	Grains.
Chloride of potassium.....	1.562
“ sodium.....	309.502
Sulphate of soda.....	28.196
Bi-carbonate of soda.....	94.409
“ lime.....	3.961
“ magnesia.....	3.581
	441.211
Carbonic acid, free.....	5.044
	446.255

The water was examined for barium and strontium, and these
 were both found to be absent. It was, however, found to contain
 a trace of lithium, a faint trace of bromine, and very distinct
 traces of iodine.

Natural
waters, *cont.*
Water from
boring at
Deloraine
(1,943 feet),
Man.

2.—From the same locality as the preceding water, and from the same boring, but taken at a greater depth, namely 1,943 feet, and at a much later date, that is to say, in February, 1894.

When first received the water was somewhat turbid, but on standing became perfectly clear and bright, with deposition of a small quantity of a brownish-yellow coloured sediment, consisting of argillaceous matter with some grains of colourless quartz, and a trifling quantity of ferric hydrate and organic matter.

The supernatant, clear and bright water, decanted from the sediment in question, was colourless and odourless and had a mildly saline taste. It exhibited a neutral reaction, when concentrated to a small volume, however, it becomes distinctly alkaline. The specific gravity of the water, at 15.5° C., was found to be 1.0049.

An analysis by Mr. Wait showed it to contain—in 1,000 parts, by weight:

Potassa	0.0111
Soda	3.1433
Lime	0.0163
Magnesia	0.0094
Alumina and ferrous oxide	0.0002
Chlorine	2.7164
Sulphuric acid	0.2046
Carbonic acid	0.9398
Silica	0.0151
	7.0562
Less oxygen equivalent to chlorine	0.6121
	6.4441

It may be reasonably assumed that the foregoing acids and bases exist in the water in the following state of combination:

(Carbonates calculated as anhydrous bi-carbonates, and the salts without their water of crystallisation.)

Chloride of potassium	0.0177
“ sodium	4.4625
Sulphate of soda	0.3632
Bi-carbonate of soda	1.4998
“ lime	0.0419
“ magnesia	0.0301
Alumina with a little ferrous oxide	0.0002
Silica	0.0151
	6.4305
Carbonic acid, free	0.0136
	6.4441

An imperial gallon of the water, at the above-mentioned temperature, would contain :

	Grains.
Chloride of potassium	1·245
“ sodium	313·915
Sulphate of soda	25·549
Bi-carbonate of soda	105·504
“ lime	2·947
“ magnesia	2·117
Alumina with a little ferrous oxide	0·014
Silica	1·062
	452·353
Carbonic acid, free	0·957
	453·310

Natural
waters, *cont.*

Water from
boring at
Deloraine
(1,943 feet),
Man., *cont.*

Boiling produced only a slight precipitate, which consisted of carbonate of lime with a little carbonate of magnesia.

The larger amount of water at the disposal of the operator, on this occasion, enabled him, not only to confirm the absence of barium and strontium, and to detect and estimate the silica, alumina and iron, but also to obtain satisfactory evidence of the presence of traces of boric acid and phosphoric acid, in addition to that of lithium, iodine and bromine, previously detected in the former sample of this water.

As may be seen on comparing the analyses of these two samples of the water, there is no very appreciable difference in the composition of that of the first collection, and that of the second, collected some nineteen months later and coming from a somewhat greater (eighty-eight feet) depth.

3.—From a spring at La Saline, east side of the Athabasca River, North-west Territory. Collected by Mr. R. G. McConnell, 1890. Water from a
spring at La
Saline, Atha-
basca River,
N.W.T.

Specific gravity, at 15·5° C., 1·052. Agreeably with the results of an analysis conducted by Mr. Wait, it contained, in 1,000 parts, by weight :

Potassium	0·868
Sodium	23·937
Calcium	1·574
Magnesium	0·496
Sulphuric acid (SO ₄)	4·702
Chlorine	38·461
	70·038
Chlorine required, in addition to that found, to satisfy bases	0·056
	70·094

Natural
waters, *cont.*

Water from a
spring at La
Saline, Atha-
basca River,
N.W.T.,
con.

Hypothetical combination :

Chloride of potassium	1.655
“ sodium	60.883
“ magnesium	1.049
Sulphate of lime	5.352
“ magnesia	1.156
	70.094

Total dissolved solid matter, by direct experiment,
dried at 180° C., 69.616.

There was not enough of the water at the disposal of the operator to admit of his examining it for any of the more rarely occurring constituents.

Water from a
spring near
Red Clay
Creek, Atha-
basca River,
N.W.T.

4.—From a spring on the bank of the Athabasca River, two miles above the Red Clay Creek, district of Athabasca, North-west Territory. Collected by Mr. R. G. McConnell, 1890.

Specific gravity at 15.5° C., 1.012. An analysis, by Mr. Wait, showed it to contain, in 1,000 parts, by weight :

Potassium	0.036
Sodium	4.783
Calcium	0.947
Magnesium	0.122
Sulphuric acid (SO ₄)	2.759
Chlorine	7.394
	16.041

Chlorine required, in addition to that found, to
satisfy bases..... 0.021

16.062

Hypothetical combination :

Chloride of potassium	0.069
“ sodium	12.165
Sulphate of lime	3.220
“ magnesia	0.608
	16.062

Total dissolved solid matter, by direct experiment,
dried at 180° C., 16.263.

The quantity of the water at the disposal of the operator was too limited to allow of his examining it for any of the more rarely occurring constituents.

Water from a
spring near
Wallace,
Cumberland
county, N.S.

5.—From a spring in the vicinity of Wallace, Cumberland county, province of Nova Scotia. Examined for Mr. A. Macfarlane.

The water contained a little suspended matter, which was removed by filtration. The filtered water, which was colourless and odourless, possessed a faintly saline taste, and was found to

have a specific gravity, at 15.5° C., of 1.001, and to contain 1.827 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

A qualitative analysis, by Mr. Wait, showed it to contain :

Potassa.....	trace.
Soda.....	large quantity.
Lime.....	somewhat small quantity.
Sulphuric acid.....	small quantity.
Carbonic acid	very small quantity.
Chlorine.....	large quantity.

Natural
waters, *cont.*
Water from a
spring near
Wallace,
Cumberland
county, N. S.,
cont.

Boiling produced a slight precipitate, consisting of carbonate of lime.

6.—From a spring at East Bay, Cape Breton county, province of Nova Scotia.

The water was colourless and odourless, and had a bitter saline taste. It was found to have a specific gravity, at 15.5° C., of 1.006, and to contain 8.564 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

Mr. Wait made a qualitative analysis of this water and found it to contain :

Potassa.....	trace.
Soda.....	moderately large quantity.
Lime.....	fairly large quantity.
Magnesia.....	trace.
Sulphuric acid.....	trace.
Carbonic acid.....	trace.
Silica.....	trace.
Chlorine.....	large quantity.

Boiling produced no precipitate.

7.—From a spring on the North River, about eight miles from Truro, Colchester county, province of Nova Scotia. Examined for Mr. E. A. Charters.

The water was both colourless and odourless. It had a saline taste, and contained 10.498 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

A qualitative analysis afforded Mr. Wait the following results :

Potassa.....	trace.
Soda.....	large quantity.
Lime.....	rather large quantity.
Magnesia.....	small quantity.
Sulphuric acid.....	rather large quantity.
Carbonic acid.....	trace.
Chlorine.....	large quantity.

Water from a
spring on
North River,
Colchester
county, N. S.

Natural
waters, *cont.*
Water from a
spring at
Sussex, King's
county, N. B.

- 8.—From a spring at Sussex, King's county, province of New Brunswick. Examined for Mr. F. W. Stockton.

The water, as received, contained a small quantity of white flocculent suspended matter—this was removed by filtration. The filtered water had a pale brownish-yellow colour, and a faintly bitter saline taste. It was found to have a specific gravity, at 15.5° C., of 1.001 and to contain 2.717 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

Agreeably with the results of a qualitative analysis, conducted by Mr. Wait, it contained :

Potassa.....	trace.
Soda.....	large quantity.
Lime.....	very small quantity.
Magnesia.....	rather large quantity.
Sulphuric acid.....	small quantity.
Carbonic acid.....	small quantity.
Chlorine.....	large quantity.
Organic matter.....	very small quantity.

Boiling produced a precipitate, consisting of carbonate of lime.

Water from a
spring at
Sussex, King's
county, N. B.

- 9.—From a spring at Sussex, King's county, province of New Brunswick. Examined for Mr. G. H. Congle.

The water was found to be clear, bright and colourless ; odourless and devoid of any marked taste. It contained 0.945 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

A qualitative analysis, by Mr. Wait, showed it to contain :

Lime.....	large quantity,
Magnesia.....	trace.
Sulphuric acid.....	large quantity.
Chlorine.....	none.

Water from
L'Avenir,
Drummond
county, Que.

- 10.—Water from L'Avenir, township of Durham, Drummond county, province of Quebec. Examined for Mr. D. A. Sutherland.

The water, which had a very pale yellow colour, was odourless and devoid of any marked taste. It contained 0.157 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

Mr. Wait made a qualitative analysis of this water and found it to contain :

Soda	small quantity.
Lime	very small quantity.
Magnesia	trace.
Ferrous oxide	trace.
Carbonic acid	very small quantity.
Chlorine	very small quantity.
Organic matter	trace.

Natural
waters, *cont.*
Water from
l'Avenir,
Drummond
county, Que.,
cont.

Boiling did not produce any precipitate.

11.—Also from l'Avenir, township of Durham, Drummond county. Examined for Mr. D. A. Sutherland.

Water from
l'Avenir,
Drummond
county, Que.

This water, when received, was slightly opalescent and smelt strongly of sulphuretted hydrogen. It contained 0.428 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

A qualitative analysis, by Mr. Wait, showed it to contain :

Soda	very small quantity.
Lime	small quantity.
Magnesia	trace.
Ferrous oxide	trace.
Carbonic acid	small quantity.
Chlorine	very small quantity.
Organic matter	very small quantity.

Boiling produced a slight precipitate, consisting of carbonate of lime.

12.—From a boring in West Belleville, Hastings county, province of Ontario. Examined for Mr. H. Corby.

Water from a
boring in
West Belle-
ville, Has-
tings county,
Ont.

The water, as received, contained a small quantity of suspended matter—this was removed by filtration. The filtered water was colourless and odourless. It had a bitter saline taste ; a specific gravity, at 15.5° C., of 1.011 ; and contained 14.637 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

Agreeably with the results of a qualitative analysis, conducted by Mr. Wait, it contained :

Potassa	trace.
Soda	very large quantity.
Lithia	trace.
Baryta	trace.
Lime	very large quantity.
Magnesia	large quantity.
Ferrous oxide	trace.
Sulphuric acid	large quantity.
Chlorine	very large quantity.
Iodine	trace.

Natural
waters, *cont.*

This water rises from the Trenton formation. It would appear to belong to the same class of waters as those of St. Catharines, Ancaster, Whitby and Hallowell, which were examined by Dr. T. S. Hunt—Geology of Canada, 1863.

Water from
Rednersville,
Prince-
Edward
county, Ont.

- 13.—From the farm of Mr. E. A. Brickman, Rednersville, Prince Edward county, province of Ontario. Examined for Mr. G. F. Clarke.

The sample received for examination was colourless, odourless, and devoid of any marked taste. It contained 0.271 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

A qualitative analysis, by Mr. Wait, showed it to contain :

Soda	very small quantity.
Lime	small quantity.
Magnesia	very small quantity.
Sulphuric acid	small quantity.
Carbonic acid	very small quantity.
Chlorine	very small quantity.

Boiling produced a slight precipitate, consisting of carbonate of lime with a little sulphate of lime.

Water from a
spring near
Davenport
station, York
county, Ont.

- 14.—From a spring about half a mile from Davenport station, in the township of York, York county, province of Ontario. Examined for Mr. G. F. Clarke.

The water contained a very appreciable amount of white, loosely flocculent, suspended matter—this was removed by filtration. The filtered water was colourless and odourless, and devoid of any marked taste. It contained 0.414 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

Mr. Wait made a qualitative analysis of this water and found it to contain :

Lime	small quantity.
Magnesia	very small quantity.
Sulphuric acid	very small quantity.
Phosphoric acid	trace.
Carbonic acid	small quantity.
Chlorine	trace.
Organic matter	very small quantity.

Water from
Niagara-on-
the-Lake,
Lincoln
county, Ont.

- 15.—From Niagara-on-the-Lake, township of Niagara, Lincoln county, province of Ontario. Examined for Mr. G. F. Clarke.

When received, this water was turbid and contained a somewhat large quantity of a reddish-brown sediment. The latter was removed by filtration. The filtered water, which was colourless and devoid of any marked taste, was found to contain 0.309

parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water. Natural waters, *cont.*

A qualitative analysis, conducted by Mr. Wait, showed it to contain : Water from Niagara-on-the-Lake, Lincoln county, Ont., *cont.*

Soda.....	very small quantity.
Lime.....	small quantity.
Sulphuric acid.....	small quantity.
Carbonic acid.....	very small quantity.
Chlorine.....	very small quantity.

Boiling produced a slight precipitate, consisting of carbonate, with a little sulphate, of lime.

- 16.—From a spring on the north bank of the Rideau River, about four hundred yards below the dam at Hog's Back, township of Nepean, Carleton county, province of Ontario. Collected by Mr. R. L. Broadbent, November 1, 1891. Water from a spring on the Rideau River, Carleton county, Ont.

The water was colourless, odourless, and devoid of any marked taste. It was found to have a specific gravity, at 15·5° C., of 1·0003, and to contain 0·287 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

Agreeably with the results of a qualitative analysis, conducted by Mr. Wait, it contained :

Soda.....	very small quantity.
Lime.....	small quantity.
Magnesia.....	very small quantity.
Ferrous oxide.....	trace.
Sulphuric acid.....	very small quantity.
Carbonic acid.....	small quantity.
Silica.....	very small quantity.
Chlorine.....	very small quantity.
Organic matter.....	trace.

Boiling produced a slight precipitate, consisting of carbonate of lime with a very small quantity of carbonate of magnesia and a trace of iron.

- 17.—From Moose Jaw, district of Assiniboia, North-west Territory. Examined for Mr. Seymour Green.

The sample of this water received for examination contained a small quantity of brownish coloured suspended matter. This was removed by filtration. The filtered water was colourless and odourless ; taste, mildly saline ; reaction, neutral ; specific gravity, at 15·5° C., 1·0022. It contained 2·081 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water. Water from Moose Jaw, district of Assiniboia, N.W.T.

Natural
waters, *cont.*
Water from
Moose Jaw,
district of
Assiniboia,
N. W. T.,
cont.

Mr. Wait made a qualitative analysis of this water and found it to contain :

Potassa.....	trace.
Soda.....	large quantity.
Lime.....	small quantity.
Magnesia ..	large quantity.
Sulphuric acid.....	large quantity.
Carbonic acid.....	large quantity.
Chlorine.....	small quantity.
Organic matter.....	trace.

Boiling produced a somewhat copious precipitate, consisting of carbonate of lime with some carbonate of magnesia.

Water from
a boring at
Medicine Hat,
district of
Assiniboia,
N.W.T.

18.—From a boring at Medicine Hat, district of Assiniboia, Northwest Territory. Examined for Mr. E. Walton.

The water was colourless and odourless ; taste, saline. It was found to contain 5.848 parts of dissolved saline matter, dried at 180° C., in 1,000 parts, by weight, of the water.

A qualitative analysis, by Mr. Wait, gave :

Soda.....	large quantity.
Lime.....	small quantity.
Magnesia.....	trace.
Carbonic acid.....	small quantity.
Chlorine.....	large quantity.
Organic matter.....	very small quantity.

Boiling produced a slight precipitate, consisting of carbonate of lime.

Water from
a spring on
Kaslo Creek,
Kootanie
Lake, B.C.

19.—From a spring on Kaslo Creek, about four miles from its entry into Kootanie Lake, West Kootanie district, province of British Columbia. Examined for Mr. T. P. Lendrum.

It was bright, colourless, and odourless ; had a specific gravity, at 15.5° C., of 1.002, and was found to contain 1.525 parts of dissolved saline matter, dried at 180° C., in 1000 parts, by weight, of the water.

Agreeably with the results of a qualitative analysis, conducted by Mr. Wait, it contained :

Soda.....	very small quantity.
Lime.....	large quantity.
Magnesia.....	large quantity.
Ferrous oxide.....	trace.
Carbonic acid.....	very large quantity.
Chlorine.....	very small quantity.
Organic matter.....	trace.

Boiling produced a copious precipitate, consisting of carbonates of lime and magnesia.

BRICK AND POTTERY-CLAYS.

PROVINCE OF PRINCE EDWARD ISLAND.

From the
Province of
Prince
Edward
Island.

- 1.—From mouth of harbour at Charlottetown.

Colour,* reddish-brown; slightly plastic; when burnt, has a pleasing reddish-brown colour. Is well adapted for the manufacture of pressed brick or other pressed ware, i.e., architectural ornamentations. Perhaps scarcely sufficiently plastic for the potters use.

PROVINCE OF NOVA SCOTIA.

From the
Province of
Nova Scotia.

- 2.—From the east side of East Bay, Bras d'Or Lake, about twenty-five miles from Sydney, Cape Breton county.

A faint greenish coloured, plastic clay, containing a somewhat large proportion of gritty matter; when burnt, assumes a very pale reddish-brown colour; is fusible at a somewhat elevated temperature. It is suitable for the manufacture of ordinary building brick and common pottery.

- 3.—From the vicinity of Middleton, southern slope of North Mountains, Annapolis county. Examined for Mr. Isaiah Dodge.

a. A light gray, non-calcareous, but very slightly plastic, clay; burns white, with a faint reddish tinge; fuses at a somewhat elevated temperature. Is suitable for the manufacture of common building brick.

b. A bluish-gray, calcareous, but very slightly plastic, clay; when burnt assumes a pale reddish-white colour; fuses at a somewhat elevated temperature. Is suitable for the manufacture of common building brick.

c. A reddish-brown, non-calcareous, plastic clay; when burnt, has a red colour; fuses at a somewhat elevated temperature. Is suitable for the manufacture of bricks, drain-tiles, and similar ware.

- 4.—From McKenzie Brook, Middle Musquodoboit—similar material, however, occurs on either side of the Musquodoboit River, extending from Middle to Upper Musquodoboit, Halifax county. Collected by Mr. E. R. Faribault.

* The colour ascribed to the various clays is, in all instances, that of the air-dried material.

Brick and
pottery clays,
cont.

From the
province of
Nova Scotia,
cont.

Colour, light pearl gray, dark gray, brownish-red—mottled ; is non-calcareous ; plastic ; when burnt assumes a very pale reddish-brown colour ; is rather difficultly fusible at a high temperature. It would be well suited for the manufacture of ordinary building brick, and would most probably be found sufficiently refractory for stove-linings ; it could also be used for the manufacture of many varieties of earthenware.

Another sample of this material, answering in the main, to the above description, comprised fragments of a pure light pearl-gray colour, whilst others again were wholly dark gray. The two kinds were examined separately. The former was found to be highly plastic ; when burnt, of a pure white colour, and very difficultly fusible. Such material would, in addition to the uses above pointed out, be well adapted for the manufacture of the finer varieties of stoneware. The dark gray coloured fragments consisted of a good plastic clay, which, when burnt, assumed a pale reddish-white colour, and proved to be somewhat difficultly fusible. Its uses would be more strictly confined to those referred to above, when speaking of the material as a whole.

From the
North-west
Territory.

NORTH-WEST TERRITORY.

- 5.—From Crooked Creek, near Waterton Lake, district of Alberta. Collected by Mr. T. C. Weston, 1883.

Colour, light gray ; calcareous ; very plastic ; when burnt, very pale reddish-brown ; fusible at a somewhat elevated temperature. Is suitable for the manufacture of ordinary building brick, and common pottery.

- 6.—Occurs intercalated in boulder-clay, at Coal Banks, Belly River, district of Alberta. Collected by Mr. T. C. Weston, 1883.

Colour, brownish-yellow ; is non-calcareous ; very slightly plastic ; when burnt, has a pale brownish-yellow colour ; is fusible at a somewhat elevated temperature. The burnt mass is more or less tender—hence this material could not advantageously be employed for the manufacture of bricks.

- 7.—From three miles above Coal Banks, Belly River, district of Alberta. Collected by Mr. T. C. Weston, 1883.

Colour, ash-gray ; is calcareous ; only slightly plastic ; when burnt, has a brownish-yellow colour ; is fusible at a somewhat elevated temperature. The burnt mass is more or less tender, consequently this material would be but ill adapted for the manufacture of bricks.

- 8.—From a two-inch parting in coal seam at the Galt mine, Coal Banks, Belly River, district of Alberta. Collected by Mr. T. C. Weston, 1883.

Brick and pottery clays, cont.

Colour, light gray; is non-calcareous; plastic; when burnt, assumes a brownish-red colour; is fusible at a somewhat elevated temperature. This clay is well suited for the manufacture of ordinary building brick.

From the North-west Territory, cont.

- 9.—Occurs overlying boulder-clay, near Fort Kipp, Old Man River, district of Alberta. Collected by Mr. T. C. Weston, 1883.

Colour, ash-gray; is slightly calcareous; very plastic; when burnt, assumes a reddish-brown colour; fusible at a somewhat elevated temperature. It is well suited for the manufacture of ordinary building brick and common pottery.

- 10.—From Dutch Fred's crossing, Waterton River, district of Alberta. Collected by Mr. T. C. Weston, 1883.

Colour, bluish-gray; is calcareous; only slightly plastic; when burnt, has a reddish-brown colour; is fusible at a somewhat elevated temperature. Would serve for the manufacture of common building brick.

- 11.—From an eight-inch thick deposit on Pincher Creek, district of Alberta. Collected by Mr. T. C. Weston, 1883.

Colour, purplish-brown; is non-calcareous; plastic; when burnt, assumes a reddish-brown colour; is fusible at a somewhat elevated temperature. Might be employed for the manufacture of ordinary building brick and common pottery.

- 12.—From a deposit seven feet thick, on Pincher Creek, district of Alberta. Collected by Mr. T. C. Weston, 1883.

Colour, bluish-gray; is slightly calcareous; plastic; when burnt has a brownish-yellow colour; is fusible at a somewhat elevated temperature. Could be used for the manufacture of ordinary building brick, and common pottery.

- 13.—Also from Pincher Creek, district of Alberta. Collected by Mr. T. C. Weston, 1883.

Colour, light brownish-red; is calcareous; plastic; when burnt assumes a reddish-brown colour; is fusible at a somewhat elevated temperature. Might be employed for the manufacture of ordinary building brick.

Brick and
pottery clays,
cont.

From the
North-west
Territory,
cont.

- 14.—From lignite deposit on the south side of the South Saskatchewan River, about six miles above Medicine Hat, district of Assiniboia. Collected by Mr. T. C. Weston, 1884.

Colour, dark bluish-gray; is very slightly calcareous; plastic; when burnt has a pale brownish-yellow colour; is fusible at a somewhat elevated temperature. Could be used for the manufacture of ordinary building brick, drain tiles, and similar ware.

- 15.—From base of Fox Hills, White Mud River, district of Assiniboia. Collected by Mr. R. G. McConnell, 1883.

Colour, dark gray; is non-calcareous; plastic; when burnt has a very pale dull yellow colour; is somewhat difficultly fusible at a high temperature. This clay is well adapted for the manufacture of ordinary building brick; also for stove linings or even a fire-brick in which a high degree of refractoriness was not called for.

- 16.—From White Mud River, near the mouth of Farewell Creek, district of Assiniboia. Collected by Mr. R. G. McConnell, 1883.

Colour, pale bluish-grayish-white; is non-calcareous; highly plastic; when burnt, has a faint dull yellowish white colour; is not very readily fusible at an elevated temperature. Would be well adapted for the manufacture of ordinary building brick, common pottery, or even some of the finer kinds of stoneware.

- 17.—From above the boulder-clay, eight miles above the Forks of Red Deer River, district of Assiniboia. Collected by Mr. R. G. McConnell, 1883.

Colour, dark gray; non-calcareous; very plastic; when burnt, assumes a yellowish-red colour; is fusible at a somewhat elevated temperature. It is well suited for the manufacture of ordinary building brick and common pottery.

- 18.—From the Cypress Hills, district of Assiniboia. Collected by Mr. R. G. McConnell, 1883.

Colour, pale yellowish-gray; is non-calcareous; highly plastic; when burnt, has a dull yellow colour; is fusible at a somewhat elevated temperature. Might advantageously be employed for the manufacture of ordinary building brick and common pottery.

- 19.—From the Hazard coal mine, Souris River, eight miles south-east of Estevan on the Soo branch of the Canadian Pacific Railway, district of Assiniboia. Collected by Dr. A. R. C. Selwyn, 1892.

Colour, bluish-grey ; is highly calcareous ; very plastic ; when burnt, has a very pale reddish-brown colour ; is readily fusible at a somewhat elevated temperature. It would serve for the manufacture of ordinary building brick.

Brick and pottery clays, cont.

From the North-west Territory, cont.

- 20.—From the east-half of section 28, township 12, range 24, west of the second initial meridian, district of Assiniboia. Presented by Mr. W. H. Stevenson, 1886.

Colour, pale, bluish-grayish-white ; is non-calcareous ; highly plastic ; burns white, or all but ; is very difficultly fusible at a high temperature. It is well suited for the manufacture of ordinary building brick, stove-linings, and would make a fairly refractory fire-brick ; it could also be used for the manufacture of pottery, including the finer varieties of stoneware.

- 21.—From vicinity of Pasqua, township 16, range 25, west of the 2nd initial meridian, district of Assiniboia.

All that has been said in regard to the preceding sample of clay, applies equally well to this one, apart from the fact that, in this instance, the material burnt perfectly white. This clay may not improbably be from an extension of the same deposit.

PROVINCE OF BRITISH COLUMBIA.

From the province of British Columbia.

- 22.—From the North Arm, Burrard Inlet, New Westminster district. Examined for Mr. J. C. Keith.

Colour, light gray ; is non-calcareous ; plastic ; when burnt, has a reddish-brown colour ; is fusible at a somewhat elevated temperature. Might advantageously be employed for the manufacture of ordinary building brick and common pottery.

- 23.—From near Saanich, Vancouver Island.

Colour, bluish-gray ; is non-calcareous ; plastic ; when burnt, assumes a pale reddish-brown colour ; is somewhat readily fusible at an elevated temperature. Would be found well suited for the manufacture of ordinary building brick and common earthenware.

- 24.—From about three miles up Guichon Creek, Nicola River, Kamloops division of Yale district.

Colour, light brown ; is non-calcareous ; highly plastic ; when burnt, has a pale reddish-brown colour ; is fusible at a somewhat elevated temperature. An excellent clay for the manufacture of ordinary building brick, drain-tiles, and all kinds of common earthenware.

Brick and
pottery clays,
cont.

From the
province of
Manitoba.

For description and analysis of a fire-clay from Souris City, Man., see under 'Rocks,' ante, No. 4. A reference to the occurrence of China-stone, which is used in the manufacture of porcelain, in British Columbia, will be found under Miscellaneous Examinations, beyond.

MISCELLANEOUS EXAMINATIONS.

- China-stone. 1.—CHINA-STONE. A light bluish-gray granitic rock, having its felspathic constituent more or less decomposed, but not completely kaolinised, and containing little or no mica, has been met with and according to reports occurs in large quantity, on the west bank of the Thompson River, opposite Spatsum station on the line of the west bank of the Canadian Pacific Railway, Yale district, province of British Columbia. China stone is much used in the manufacture of porcelain, and especially for the production of glazes.
- Ferruginous sandstone. 2.—FERRUGINOUS SANDSTONE. A coarse grained sandstone from the Athabasca River, district of Athabasca, North-west Territory, collected by Mr. R. G. McConnell, has been examined by Mr. Wait and found to contain ferric oxide equivalent to 12.43 per cent of metallic iron.
- Ferruginous rock. 3.—FERRUGINOUS ROCK. From Meadow's Road, East Bay, Cape Breton county, province of Nova Scotia. Examined for Mr. Joseph McMillan. It consisted of an association of quartz and calcite, through which was disseminated some earthy red hematite and a few scales of specular iron. Mr. Wait found it to contain 9.51 per cent of metallic iron.
- Phosphatic shale. 4.—PHOSPHATIC SHALE. From the Niobrara formation on Wilson River, section 18, township 25, range 20, west of the principal meridian, province of Manitoba. Collected by Mr. J. B. Tyrrell, who describes it as occurring at the bottom of the bank of the river, in an outcrop of a bed, of unknown extent, of shale made up largely of fish remains, underlying fifteen feet of a thick bedded calcareous shale.
- This shale, which is of a grayish-black colour, has been examined by Mr. Johnston and found to contain 17.27 per cent of phosphoric acid, which corresponds to 37.70 per cent of tri-basic phosphate of lime.

- 5.—COPPER ORE. From the Tender-foot claim, Copper Creek, north side of Kamloops Lake, Yale district, province of British Columbia. An earthy admixture of blue and green carbonate of copper and ferric hydrate. Agreeably with the results of determinations by Mr. Wait, it contained 41.66 of metallic copper—and submitted to assay, Mr. Johnston found it to contain a trace of gold, and silver at the rate of 18.200 ounces to the ton of 2,000 lbs. Miscellaneous examinations, cont.
Copper ore.
- 6.—ALUNOGEN. A sample of material, received from Mr. J. W. Mackay, Alunogen. reported as occurring in the form of a deposit, four miles west of Savona station and near the line of the Canadian Pacific Railway, Yale district, province of British Columbia, was examined by Mr. Wait and found to consist of alunogen.



GEOLOGICAL SURVEY OF CANADA
ALFRED R. C. SELWYN, C.M.G., LL.D., F.R.S., DIRECTOR

DIVISION OF

MINERAL STATISTICS AND MINES

ANNUAL REPORT

FOR

1892

ELFRIC DREW INGALL
*Associate of the Royal School of Mines, England,
Mining Engineer to the Geological Survey of Canada*
IN CHARGE

H. P. H. BRUMELL, F.G.S.A.
Assistant to the Division



OTTAWA
PRINTED BY S. E. DAWSON, PRINTER TO THE QUEEN'S MOST
EXCELLENT MAJESTY
1894

NOTE.

Except for the figures of imports, which refer to the fiscal year, beginning 1st July, the year used throughout this report is the calendar year, and the ton, that of 2,000 pounds, unless otherwise stated.

The figures give throughout the report referring to exports and imports are compiled from data obtained from the books of the Customs Department, and will occasionally show discrepancies, which, however, there are no means of correcting.

The exports and imports, under the heading of each province, do not necessarily represent the production and consumption of the province, *e. g.*, material produced in Ontario is often shipped from Montreal and entered there for export, so falling under the heading, Quebec.

The values of the metallic minerals produced, as per returns to this Department, are calculated on the basis of their metallic contents at the average market price of the metal for 1891. Spot values have been adopted for the figures of production of the non metallic minerals.

Throughout this report any bearings given are magnetic, except where otherwise stated.

N.E.S. = Not elsewhere specified.

To Dr. A. R. C. SELWYN, C.M.G., F.R.S., &c.,
Director and Deputy Head,
Geological Survey Department.

SIR,—I beg herewith to hand you the report of this division on mining and mineral production throughout the Dominion during 1892.

As in past years, it will be found to represent as complete a review of the mineral activities of the country and of their commercial results as it is possible to obtain with the means at command. These include the personal investigations of the officers of the division, supplemented by the issue of circulars asking the production direct from the operators themselves. Information selected from official provincial reports and various other sources is also incorporated with a view to giving all the authentic information available.

The labour of collecting, comparing and collating these very varied materials so as to ensure accurate results and secure a complete and uniform presentment of them is very great, but it is hoped that the result will prove satisfactory.

As in the past, care is still taken to avoid injury to private interests in the manner of publishing results. The confidence of the mining community thus gained has resulted in an increasingly hearty response to our circulars, although, to complete our data, personal application is yet necessitated with a small number of people and a yet more prompt response on the part of all applied to will help still further towards an earlier publication of the material.

The preliminary summary of the mineral production in 1892, was issued April 13th, 1893, a revision of which will be found in the table on page 5.

The delay in issuing the report for 1891, from causes explained in that volume, has also caused the present report to be late, but the retardation of the work of the division is in a fair way to be made up, the report for 1893 being well on towards completion. However, in the interim a revised statement of the mineral production of Canada for 1886 to 1891, inclusive, was issued on 7th March, 1893, and a preliminary statement of the mineral production for the year 1893 on 5th of April, 1894.

Apart from the preparation of the annual report, the other functions of the division have been performed as heretofore.

Numerous inquiries have been received and answered respecting the mining and mineral resources of the country, often involving considerable research to give the details asked for.

A system of classification of the mining records in the possession of the division has been inaugurated which when completed will ensure easy and rapid access to all the available data regarding any mineral deposits in the Dominion and enable all further data obtained to be properly filed away. As this has to be done, however, in the intervals of the current work, its progress is necessarily slow and the recent appointment of Mr. James White to the topographical staff leaves our staff one short.

During the summer season the field work of the officers of the division was as follows : The writer was all the summer engaged in a study of the gold and silver mining districts at West Kootenay, B.C., whilst after returning time was found for hurried visits to the cinnabar deposit near Kamloops, B.C., and the collieries of the Cascade Basin and Lethbridge in the North-west Territories. Mr. H. P. Brumell made a tour through various mining districts in Nova Scotia, New Brunswick, Quebec and Ontario. Mr. James White continued the mining survey of the phosphate, iron and mica district traversed by the Kingston and Pembroke Railway.

It is desired to gratefully acknowledge the aid received from various sources. Thanks are due to those who, although too numerous to specify here, have, by answering our circulars or letters, provided much valuable material for the compilation of this report. Thanks are also due for aid received from field officers of the Survey in making inquiries for us. Special mention must be made of the services rendered by my colleague, Mr. H. P. H. Brumell, assistant to the division, for his very important and efficient aid in every branch of the work.

Our acknowledgments are also due the provincial departments of mines of Nova Scotia and British Columbia and to the Dominion customs department for aid received.

I have the honour to be, sir,

Your obedient servant,

ELFRIC DREW INGALL,

July 5th, 1894.

SUMMARY OF THE MINERAL PRODUCTION OF CANADA IN 1891 AND 1892.

PRODUCT.	1891.		1892.	
	Quantity.	Value.	Quantity.	Value.
<i>Metallic.</i>				
Copper (fine, in ore, etc.).. lbs.	8,928,921	\$1,160,760	7,087,275	\$ 826,849
Gold	51,303	930,614	50,350	907,601
Iron ore	68,979	142,005	103,248	263,866
Lead (fine, in ore, etc.).. lbs.	588,665	25,607	1,768,420	72,505
Nickle (fine, in ore, etc.).. "	4,626,627	2,775,976	2,413,717	1,399,956
Platinum		10,000		3,500
Silver (fine, in ore, etc.) .. oz.	414,523	406,233	310,651	269,489
Total metallic.....		\$5,451,195		\$3,743,766
<i>Non-metallic.</i>				
Antimony	10	\$ 60		
Arsenic.....	20	1,000		
Asbestos.....	9,279	999,878	6,082	\$ 390,462
Coal	3,623,076	8,144,247	3,292,547	7,184,510
Coke	57,084	175,592	56,135	160,249
Feldspar.....	685	3,425	175	525
Fire clay and mfrs. of.....		750		9,567
Graphite.....	260	1,560	167	3,763
Grindstones.....	4,479	42,587	5,283	51,187
Gypsum	203,605	206,251	241,048	241,127
Limestone for flux.....	11,376	11,547	22,967	21,492
Manganese ore.....	255	6,694	115	10,250
Mica		71,510		104,745
Mineral pigments—				
Baryta	tons.		315	1,260
Ochres	"	900	390	5,800
Mineral water.....	galls.	427,485	640,380	75,348
Moulding sand.....	tons.	230	345	1,380
Natural gas.....				150,000
Petroleum.....	brls.	755,298	779,753	982,489
Phosphate.....	tons.	23,588	241,603	157,424
Precious stones.....		1,000		1,000
Pyrites	tons.	67,731	203,193	179,310
Salt	"	45,021	45,486	162,041
Soapstone	"		1,374	6,240
Structural materials and clay products—				
*Bricks	M.	176,533	1,061,536	1,251,934
*Building stone	c. yds.	187,685	708,736	609,827
Cement, natural.....	brls.	93,473	88,187	94,912
do Portland.....	"		29,221	52,751
Flagstones.....	sq. ft.	27,300	13,700	1,869
Granite.....	tons.	13,637	24,302	89,326
*Lime.....	bush.	1,829,894	2,260,640	411,270
Marble.....	tons.	240	340	3,600
Pottery		258,844		265,811
Roofing cement	tons.	1,020	800	12,000
Sands and gravels, exports ..	"	243,724	297,878	85,329
Sewer pipe.....		227,300		367,660
Slate.....	tons.		(a) 5,180	69,070
Terra cotta.....		113,103		97,239
*Tiles	M.	11,839	15,689	190,857
Total non-metallic.....		\$14,359,174		\$13,503,624
do metallic.....		5,451,195		3,743,766
Estimated value of mineral products not returned (principally structural materials).....		689,631		752,610
Total		\$20,500,000		\$18,000,000

* Incomplete. (a) Owing to there being only one producer the return being confidential is not given here, but is included in the last item, viz. :—Estimated values.

EXPORTS.

EXPORTS.

MINERALS AND MINERAL PRODUCTS MINED OR MANUFACTURED IN CANADA
DURING 1892.

Product.	Value.	Product.	Value.
Asbestos, first class.....	\$ 113,595	Nickel.....	\$243,149
“ second class.....	228,133	Oil, crude and refined...	13,045
“ third class.....	31,375	Ore, iron.....	52,720
Brick.....	12,192	“ lead.....	2,509
Cement.....	938	“ manganese.....	8,205
Clay, and manufactures of	37	“ silver.....	56,688
Coal.....	2,806,770	Phosphate.....	153,764
Copper.....	277,632	Plumbago.....	4,150
Gold.....	277,825	Salt.....	504
Grindstones.....	23,567	Sand and gravel.....	85,329
Gypsum, crude.....	201,086	Slate.....	2,038
“ ground.....	20,255	Stone, unwrought.....	47,424
Iron and steel, ...about	275,000	“ wrought.....	7,698
Lime.....	121,535	Other articles.....	26,225
Mica, crude and cut.....	79,845		
“ ground.....	6,717	Total.....	\$5,229,950

EXPORTS

OF PRODUCTS OF THE MINE, WITH DESTINATIONS, DURING FISCAL YEAR 1892.

Exported to	Value.	Exported to	Value.
United States.....	\$4,806,483	British Guiana.....	\$8,679
Great Britain.....	683,094	British Possessions in Paci-	
Newfoundland.....	202,840	fic Ocean.....	5,616
Hong Kong.....	37,170	Russia.....	4,724
St. Pierre.....	30,413	Japan.....	4,571
Germany.....	27,675	Australia.....	4,408
France.....	22,547	China.....	3,834
British West Indies.....	18,533	Belgium.....	800
Sandwich Islands.....	16,888		
Holland.....	15,505	Total.....	\$5,906,471
Spanish West Indies.....	12,691		

IMPORTS.

IMPORTS.

MINERALS AND MINERAL PRODUCTS FOR FISCAL YEAR 1892.

Products.	Value.	Products.	Value.
Alum and aluminous cake.	\$ 22,849	Lead and mfrs. of.	\$ 309,388
Antimony	17,680	Lime	4,241
Arsenic	9,365	Litharge.	34,343
Asbestos and mfrs. of.	14,090	Lithographic stone.	5,047
Ashes, pot, pearl and soda.	3,377	Manganese oxide.	3,530
Asphaltum.	152,136	Marble	106,268
Borax	29,678	Mercury	15,038
Brass and mfrs. of.	537,771	Mineral water	55,763
Bricks	5,075	Nickel	50
“ bath	2,402	Ochres.	22,908
“ fire, and tiles.	122,031	Paraffine wax.	50,728
Buhrstones.	1,464	Petroleum and mfrs. of.	492,361
Building stone.	95,550	Plaster of Paris.	5,595
Cement	6,176	Platinum.	1,952
“ Portland.	281,553	Potash salts	40,822
Chalk	9,558	Precious stones	63,738
Clay, China.	41,787	Pumice	3,282
“ fire	29,049	Salt	380,958
“ all other, N.E.S.	11,783	Sand and gravel.	27,890
Coal, anthracite	5,640,346	Silex	1,244
“ bituminous	4,099,221	Slate	50,441
“ dust, &c	39,840	Soda salts	445,370
“ tar and pitch.	34,471	Stone or granite, N.E.S.	39,479
Coke (oven).	194,429	Spelter	62,550
Copper and mfrs. of.	437,764	Sulphur.	67,095
Earthenware	748,810	Tiles, sewer pipes, &c.	59,537
Emery	17,782	Tin and mfrs. of.	1,594,205
Fertilizers.	19,539	Tufa.	1,025
Flagstones.	15,048	Whiting.	26,867
Fuller's earth	2,453	Yellow metal.	73,534
Graphite.	39,633	Zinc and mfrs. of.	134,865
Grindstones	19,761		
Gypsum.	3,331		
Iron and steel	10,476,090	Total.	\$27,362,006

ABRASIVE MATERIALS.

ABRASIVE
MATERIALS.

PRODUCTION.

The only material coming properly under this heading produced during 1892 was grindstones and of which the following data only are available.

Grindstones.—The quantity of grindstones produced during the year was 5,283 tons, valued at \$51,187, the production according to provinces being as follows :—

New Brunswick.	2,821 tons, valued at \$23,577	
Nova Scotia.	2,462 “ “	27,610
	5,283 “ “	\$51,187

**ABRASIVE
MATERIALS.
Grindstones.**

The production during 1886 to 1892 inclusive was as follows; and was the result of operations in New Brunswick and Nova Scotia only :—

1886—4,000 tons, valued at.....	\$46,545
1887—5,292 “ “	64,008
1888—5,764 “ “	51,129
1889—3,404 “ “	30,863
1890—4,884 “ “	42,340
1891—4,479 “ “	42,587
1892—5,283 “ “	51,187

Tripoli.

Tripoli.—A small deposit of tripoli was noted by Mr. N. J. Giroux, of the Geological Survey, near a small lake a few miles north of Chertsey village in Montcalm county, Que., from which the inhabitants obtain small quantities which they use locally. No production of the material has, however, been reported.

EXPORTS AND IMPORTS.

The following tables give the exports and imports as obtained from the Customs Department, and explain themselves :—

ABRASIVE MATERIALS.

**Exports and
Imports.**

**TABLE 1.
IMPORTS OF “SILEX.”**

Fiscal Year.	Cwts.	Value.
1880.....	5,252	\$2,290
1881.....	3,251	1,659
1882.....	3,283	1,678
1883.....	3,543	2,058
1884.....	3,259	1,709
1885.....	3,527	1,443
1886.....	2,520	1,313
1887.....	14,533	5,073
1888.....	4,808	2,385
1889.....	5,130	1,211
1890.....	1,768	2,617
1891.....	3,674	1,929
1892.....	1,429	1,244

ABRASIVE MATERIALS.

TABLE 2.

IMPORTS OF PUMICE STONE AND EMERY.

Fiscal Year.	Value.
1880.....	\$ 7,854
1881.....	11,179
1882.....	15,762
1883.....	17,823
1884.....	16,518
1885.....	14,450
1886.....	14,458
1887.....	15,617
1888.....	18,564
1889.....	16,888
1890.....	19,925
1891.....	19,875
1892.....	21,064

ABRASIVE
MATERIALS.
Exports and
Imports.

ABRASIVE MATERIALS.

TABLE 3.

IMPORTS OF BUHRSTONES.

Fiscal Year.	Value.
1880.....	\$12,049
1881.....	6,337
1882.....	15,143
1883.....	13,242
1884.....	5,365
1885.....	4,517
1886.....	4,062
1887.....	3,545
1888.....	4,753
1889.....	5,465
1890.....	2,506
1891.....	2,089
1892.....	1,464

ABRASIVE MATERIALS.

TABLE 4.

EXPORTS OF GRINDSTONES.

Provinces.	1889.	1890.	1891.	1892.
Quebec.....	\$ 1,387	\$ 12		
Nova Scotia.....	7,150	8,536	\$12,387	\$10,575
New Brunswick.....	21,437	10,016	16,046	12,992
Manitoba.....	8			
Totals.....	\$ 29,982	\$ 18,564	\$ 28,433	\$ 23,567

ABRASIVE
MATERIALS.
Exports and
Imports.

ABRASIVE MATERIALS.
TABLE 5.
EXPORTS OF GRINDSTONES.

Year.	Value.
1884.....	\$28,186
1885.....	22,606
1886.....	24,185
1887.....	28,789
1888.....	28,176
1889.....	29,982
1890.....	18,564
1891.....	2,433
1892.....	23,567

ABRASIVE MATERIALS.
TABLE 6.
IMPORTS OF GRINDSTONES.

Fiscal Year.	Tons.	Value.
1880.....	1,044	\$11,714
1881.....	1,359	16,895
1882.....	2,098	30,654
1883.....	2,108	31,456
1884.....	2,074	30,471
1885.....	1,148	16,065
1886.....	964	12,903
1887.....	1,309	14,815
1888.....	1,721	18,263
1889.....	2,116	25,564
1890.....	1,567	20,569
1891.....	1,381	16,991
1892.....	1,484	19,761

ANTIMONY

ANTIMONY.

Statistics.

STATISTICS.

There is no production to report for the year 1892, the West Gore mines which, for many years, afforded the only supply, having closed down.

The industry through various causes has gradually fallen off since 1887 when the production was of considerable importance. What the causes of this falling off may have been are not known, though it has certainly not been from any deterioration of the Canadian ore which has always been of good quality.

The production during the past few years was as follows, and is the result of operations in the province of Nova Scotia :—

ANTIMONY.
Statistics.

1887, 584 tons, valued at.....	\$10,860
1888, 345 " "	3,696
1889, 55 " "	1,100
1890, 26½ " "	625
1891, 10 " "	60

EXPORTS AND IMPORTS.

Exports and
Imports.

The following tables of exports and imports are taken from the books of the Customs Department and explain themselves :—

ANTIMONY.

TABLE 1.

EXPORTS.

Year.	Tons.	Value.	Year.	Tons.	Value.
1880.....	40	\$ 1,948	1887.....	229	\$9,720
1881.....	34	3,308	1888.....	352½	6,894
1882.....	323	11,673	1889.....	30	695
1883.....	165	4,200	1890.....	38	1,000
1884.....	483	17,875	1891.....	3½	60
1885.....	758	36,250	1892.....		
1886.....	665	31,490			

ANTIMONY.

TABLE 2.

IMPORTS.

Fiscal Year.	Pounds.	Value.
1880.....	42,247	\$ 5,903
1881.....		7,060
1882.....	183,597	15,044
1883.....	105,346	10,355
1884.....	445,600	15,564
1885.....	82, 12	8,182
1886.....	89,787	6,951
1887.....	87,827	7,122
1888.....	120,125	12,242
1889.....	119,034	11,206
1890.....	117,066	17,439
1891.....	114,084	17,483
1892.....	190,308	17,680

ANTIMONY.

Discovery and
development.

DISCOVERY AND DEVELOPMENT.

NOVA SCOTIA.

Rawdon.—The most important deposit in Canada is undoubted that at West Gore, Rawdon, Hants county, N.S., regarding which H. P. Brumell makes the following statement from information from the owner Mr. R. MacNaughton, Truro, N.S. As the mine was abandoned and filled with water he did not make a person

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"The deposit consists of a vein about six feet wide of which twenty inches is pay-ore consisting of stibnite, kermesite, valentinite, galena and a small amount of gold in a gangue of calcite. The vein has a course about north-west and south-east dipping at an angle of eighty degrees to the south-west and cuts gray talcose slates with strike east and west and dip S. < 45°. The first-class ore assays fifty to eighty per cent of antimony, a second grade being concentrated from dump stuff to about fifty-four per cent. The entire vein contains about three pennyweights of gold to the ton.

"The underground operations consist of three shafts on the vein about 100 feet apart, the most southerly, No. 1, being sunk to a depth of 200 feet, the next, No. 2, to 80 feet and No. 3, the most northerly, to 30 feet. From the mouth of No. 3 a drift or stope 30 feet in height is run following the upper pay-streak to No. 1 shaft, which it intersects at 115 feet from the surface."

ASBESTUS.

Statistics.

ASBESTUS.

STATISTICS.

The production of this mineral during 1892 was 6,082 tons, valued at \$390,462. This shows a decrease in comparison with the previous year of 3,197 tons and \$609,416.

As observed also the returns show a great drop in values, which is due to the shipment for 1892 having consisted mostly of the lower priced grades of the mineral.

This production resulted from the operations of the mines working at Thetford, Black Lake and Coleraine in the Eastern Townships of

production of this mineral for the past eleven years.

The amount exported (see table 1) shows that nearly all the production found a market outside of Canada. In fact there are but two firms manufacturing asbestos goods in Canada.

ANTIMONY.

Discovery and
development.

NOVA SCOTIA.

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Discovery and
development.

NOVA SCOTIA.

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development.

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is due to the shipment for 1892 having consisted mostly of the lower priced grades of the mineral.

This production resulted from the operations of the mines working at Thetford, Black Lake and Coleraine in the Eastern Townships of

Quebec, together with a small amount from the asbestos deposits occurring in the Laurentian rocks of Templeton township, Ottawa county, in the same province.

ASBESTUS.

TABLE 1.

EXPORTS.

Quality.	1889.		1890.		1891.		1892.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
1st class	4,579	\$319,461	5,453	\$453,704	4,530	\$338,072	1,447	\$113,595
2nd "	593	27,308	1,172	58,973	3,186	209,833	3,185	228,133
3rd "	416	13,375	373	15,853	298	13,636	748	31,375
Totals...	5,588	\$360,144	6,998	\$528,530	8,014	\$561,541	5,380	\$373,103

Exports and Imports.

ASBESTUS.

TABLE 2.

IMPORTS.

Fiscal Year.	Value.
1885.....	\$ 674
1886.....	6,831
1887.....	7,836
1888.....	8,793
1889.....	9,943
1890.....	13,250
1891.....	13,298
1892.....	14,090

DISCOVERY AND DEVELOPMENT.

Discovery and development.

With regard to the conditions of occurrence of the deposits in the Eastern Townships and the mode of mining adopted there, full details have been given in previous reports which need not be repeated here, and details of the same nature regarding the deposit worked in Templeton are to be found in Vol. V., Annual Report of the Geological Survey Department, p. 298.

The accompanying graphic table A shows the fluctuations in production of this mineral for the past eleven years.

The amount exported (see table 1) shows that nearly all the production found a market outside of Canada. In fact there are but two firms manufacturing asbestos goods in Canada.

ASBESTUS.
List of
operators.

The Customs returns show a small importation under the heading Asbestos, probably all manufactured articles.

The following is a list of the chief operators during the year :

The Bell's Asbestos Company.

The H. W. Johns Manufacturing Company.

Messrs. Johnson & Company.

Messrs. King Brothers.

The American Asbestos Company.

The Beaver Asbestos Company.

Messrs. Frechette & Poirier.

The St. Cyr Asbestos Company.

Messrs. Ward Bros.

The Thetford Asbestos Mining Company.

The Brompton Lake Asbestos Company.

The Lambly Mining Company.

The Anglo-Canadian Asbestos Company.

The United Asbestos Company.

Messrs. W. H. Jeffrey & Company.

Messrs. J. C. Bedard & Company.

The Jas. Reed Company.

The Glasgow & Montreal Asbestos Company.

The Templeton Asbestos Company.

Besides the above mentioned there were a number of other operators who did more or less development work.

COAL.

COAL.

Statistics.

STATISTICS.

As may be seen on reference to the accompanying graphic table A there has been a very material falling off in production during 1892, amounting to 330,529 tons, whilst the decrease in the value of the production reached the sum of \$959,737, or very nearly ten per cent of the value of the coal produced in 1891. This decrease is attributed altogether to Nova Scotia and British Columbia, while in the production of both New Brunswick and the North-west Territories there was a slight increase.

It will be seen on reference to graphic table B that Nova Scotia still continues to be the largest producer, though but slightly ahead of British Columbia as to the value of the output.

The figures of production in the various provinces during past years are given in graphic tables C and D and table 1 following.

PLATE II.

Value.	COAL	
	TABLE A	
	PRODUCTION OF CANADA.	
\$4,017,225		1886
4,758,590		1887
5,259,832		1888
5,584,182		1889
6,496,110		1890
8,144,247		1891
7,184,510		1892
Value.	BY PROVINCES	
	TABLE B	
\$3,399,865		
3,305,340		
469,930		
9,375		

ANNUAL REPORT

PART S. ; ANNUAL REPORT, Vol. VI.

1889	649,409
1890	759,517
1891	1,152,588
1892	925,495

ANNUAL REPORT FOR 1892 ; DIVISION OF MINES

E. D. INGALL, M. E., IN CHARGE

COAL.

TABLE 1.

PRODUCTION IN NEW BRUNSWICK AND NORTH-WEST TERRITORIES.

COAL.

Statistics.

Year.	New Brunswick.		North-west Territories.	
	Tons.	Value.	Tons.	Value.
1887.....	10,040	\$23,607	74,152	\$157,577
1888.....	5,730	11,500	115,124	183,354
1889.....	5,673	11,133	97,364	179,640
1890.....	7,110	13,850	128,953	198,498
1891.....	5,422	11,030	174,131	437,243
1892.....	6,768	9,75	184,370	469,930

EXPORTS AND IMPORTS.

Exports and Imports.

The figures of exports and imports are as in the past taken from the books of the Customs Department and are shown in the following tables, all of which explain themselves. Numbers 2, 3 and 4 and the graphic tables E and F refer to exports only, while in tables 5, 6 and 7 will be found the figures of imports which are for the fiscal year ending 30th June :—

COAL.

TABLE 2.

EXPORTS : THE PRODUCE OF CANADA.

Provinces.	1891.		1892.	
	Tons.	Value.	Tons.	Value.
Ontario			55	\$ 248
Quebec	4,644	\$ 7,304	4,138	6,282
Nova Scotia	194,867	417,816	181,547	407,980
New Brunswick	1,747	5,194	1,905	6,639
Prince Edward Island	35	109	50	150
Manitoba	2,232	4,655	31	74
North-west Territories			36,291	67,643
British Columbia	767,734	2,958,695	599,716	2,317,734
Totals	971,259	\$3,393,773	823,733	\$2,806,770

COAL.

Exports and
Imports.

COAL.

TABLE 3.

EXPORTS : NOT THE PRODUCE OF CANADA.

Provinces.	1891.		1892.	
	Tons.	Value.	Tons.	Value.
Ontario	63,777	\$158,416	81,557	\$204,867
Quebec	11,565	25,953	8,060	16,247
Nova Scotia	2,319	6,217	2,752	6,811
New Brunswick	165	432	1,618	6,128
Manitoba	1	15	.....	.....
British Columbia .....	.....	.....	1	10
Totals.....	77,827	\$191,033	93,988	\$234,063

COAL.

TABLE 4.

EXPORTS : NOVA SCOTIA AND BRITISH COLUMBIA.

Year.	Nova Scotia.		British Columbia.	
	Tons.	Value.	Tons.	Value.
1874.....	252,124	\$647,539	51,001	\$ 278,180
1875.....	179,626	404,351	65,842	356,018
1876.....	126,520	263,543	116,910	627,754
1877.....	173,389	352,453	118,252	590,263
1878.....	154,114	293,795	165,734	698,870
1879.....	113,742	203,407	186,094	608,845
1880.....	199,552	344,148	219,878	775,008
1881.....	193,081	311,721	187,791	622,965
1882.....	216,954	390,121	179,552	61,437
1883.....	192,795	336,088	271,214	940,271
1884.....	222,709	430,330	245,478	501,440
1885.....	176,287	349,650	250,191	1,000,764
1886.....	240,459	441,693	274,466	960,649
1887.....	207,941	390,738	356,657	1,262,552
1888.....	165,863	330,115	405,071	1,605,650
1889.....	186,608	396,830	470,683	1,918,263
1890.....	202,387	426,070	508,832	1,977,191
1891.....	194,867	417,816	767,734	2,958,695
1892.....	181,547	407,980	599,716	2,317,734

COAL.

TABLE 5.

IMPORTS OF BITUMINOUS COAL.

Fiscal Year.	Tons.	Value.
1880.....	457,049	\$1,220,761
1881.....	587,024	1,741,568
1882.....	636,374	1,992,081
1883.....	911,629	2,993,198
1884.....	1,118,615	3,613,470
1885.....	1,011,875	3,197,539
1886.....	930,949	2,591,554
1887.....	1,149,792	3,126,225
1888.....	1,231,234	3,451,661
1889.....	1,248,540	3,235,171
1890.....	1,409,282	3,528,959
1891.....	1,598,855	4,060,896
1892.....	1,615,220	4,099,221

COAL.

Exports and Imports.

COAL.

TABLE 6.

IMPORTS OF ANTHRACITE COAL.

Fiscal Year.	Tons.	Value.
1880.....	516,729	\$1,509,960
1881.....	572,092	2,325,937
1882.....	638,273	2,666,356
1883.....	754,891	3,344,936
1884.....	868,000	3,831,283
1885.....	910,324	3,909,844
1886.....	995,425	4,028,050
1887.....	1,100,165	4,423,062
1888.....	2,138,627	5,291,875
1889.....	1,291,705	5,199,481
1890.....	1,201,335	4,595,727
1891.....	1,399,067	5,224,452
1892.....	1,479,106	5,640,346

COAL.

Exports and
Imports.

COAL.

TABLE 7.

IMPORTS OF COAL DUST.

Fiscal Year.	Tons.	Value.
1880.. .. .	3,565	\$ 8,877
1881.. .. .	337	666
1882.. .. .	471	900
1883.. .. .	8,154	10,082
1884.. .. .	12,782	14,600
1885.. .. .	20,185	20,412
1886.. .. .	36,230	36,996
1887.. .. .	31,401	33,178
1888.. .. .	28,808	34,730
1889.. .. .	39,980	47,139
1890.. .. .	53,104	29,818
1891.. .. .	60,127	36,130
1892.. .. .	82,091	39,840

Consumption. The approximate quantity of coal consumed in Canada during 1892, assuming that the imports for the fiscal are the same as for the calendar year, was as follows :—

	Tons.
Production	3,293,547
Imports	3,176,417
	6,469,964
Less exports	917,721
	5,552,243

This shows a decrease from figures obtained in the same way for 1891 of 80,796 tons, induced probably by the greater entry into the market of natural gas in certain parts of Ontario and the use in place of coal-gas of electric light generated by water power.

Markets.

Of the coal produced in Nova Scotia during the year $7\frac{1}{2}$ per cent only was exported, the greater part going to Newfoundland, the exportation to the United States having fallen off about one-half, while a slightly smaller quantity than usual was sent to the West Indies.

As in the past years the United States is the principal foreign market for the coal produced in British Columbia, the port of San Francisco alone during the year receiving 425,170 tons. Small quantities also were exported to China, Japan, and other Pacific markets.

NOVA SCOTIA.

In Nova Scotia there were nineteen collieries producing during the year, the production of each being shown in the following table 8, which with tables 9, 10 and 11 are compiled from information afforded us by the Department of Mines in that province.

COAL.

TABLE 8.

NOVA SCOTIA.

PRODUCTION BY COLLIERIES.

Colliery.	Tons.	Colliery.	Tons.
Chignecto.....	202	Glace Bay.....	118,291
Joggins.....	71,126	Gowrie.....	173,426
Minudie.....	2,065	International.....	125,279
Springhill.....	439,851	Ontario.....	31
Maccan.....	269	Reserve.....	173,365
Acadia.....	290,949	Victoria.....	136,234
East River.....	2,212	Sydney.....	212,793
Intercolonial.....	220,531	Rankine.....	1,398
Bridgeport.....	36,098	Sea coal.....	504
Caledonia.....	134,658	Total.....	2,175,914
Gardener.....	46,632		

COAL.

TABLE 9.

NOVA SCOTIA.

PRODUCTION, SALES AND COLLIERY CONSUMPTION.

Period.	Production.	Sales.	Colliery Consumption.
1892, first quarter..... Tons.	355,605	209,222	39,737
1892, second "..... "	609,258	563,164	55,737
1892, third "..... "	667,097	685,538	54,859
1892, fourth "..... "	543,954	506,362	45,770
Total..... "	2,175,914	1,963,286	196,103
1891..... "	2,290,935	2,071,938	195,981
1890..... "	2,222,081	2,000,444	180,589
1889..... "	1,967,032	1,741,720	177,106
1888..... "	1,989,263	1,765,895	176,336
1887..... "	1,871,338	1,702,046	156,550
1886..... "	1,682,924	1,538,504	159,512
1885..... "	1,514,470	1,405,051	142,939

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COAL.

TABLE 10.

NOVA SCOTIA.

COAL TRADE BY COUNTIES.

Year 1892.	Cumberland.		Pictou.		Cape Breton.		Other Counties.	
	Raised.	Sold.	Raised.	Sold.	Raised.	Sold.	Raised.	Sold.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
First quarter	133,129	123,786	84,301	68,162	137,382	17,030	793	244
Second "	120,089	109,800	138,172	125,759	350,755	327,467	242	138
Third "	117,093	104,220	149,090	140,229	400,047	436,395	867	694
Fourth "	143,201	131,559	132,129	119,962	268,624	253,841	.....	.....
Total, 1892.	513,512	473,365	503,692	454,112	1,156,808	1,034,733	1,902	1,076
" 1891.	583,688	517,739	500,829	453,707	1,206,064	1,100,279	354	213

COAL.

TABLE 11.

NOVA SCOTIA.

DISTRIBUTION OF COAL SOLD.

Market.	1891.	1892
	Tons.	Tons.
Nova Scotia, transported by land..	404,031	391,023
" " " " sea..	312,474	307,832
Total.....	716,505	698,855
New Brunswick.....	256,833	240,296
Prince Edward Island.....	75,570	63,435
Quebec.....	868,320	835,561
Newfoundland.....	121,651	106,399
West Indies.....	4,576	3,191
United States.....	28,483	15,549
Total.....	2,071,938	1,963,286

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The following details are taken from the report of the Department of Mines of Nova Scotia, and will show the state of the industry during 1892*.

"The returns show a sale during the past year of 1,752,934 tons against 1,849,945 tons during the preceding year.

*The tons mentioned in the following extracts are of 2,240 lbs.

"As compared with the sales of the year 1891 the most noticeable points are :—

"The home sales are 623,978 tons compared with 639,737 tons in 1891.

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"The province of Quebec took 746,037 tons against 775,286 tons in 1891.

"The sales to the United States were 13,883 tons as compared with 25,431 tons in 1891.

"The sales to Newfoundland, New Brunswick, Prince Edward Island and other points show little difference.

Cumberland County.

"The sales of the county were 422,641 tons against 462,267 tons in 1891.

"The production of the collieries of the Cumberland Railway and Coal Company was 392,724 against 459,395 tons in 1891. Since the date of the last report a complete set of underground haulage has been put in, and the surface works further improved. Safety lamps alone are used underground and no explosives.

"The Chignecto mine has remained closed, and no returns of a satisfactory character have been received of the results of the prospecting carried on for other seams.

"At the Joggins mines the system of long wall has been continued, and improvements made to the railway and wharf. The output was 63,505.

"During the past season an American company took over a number of coal leases including the Joggins and other areas in the river Hebert and Macan districts, and will, it is expected, shortly develop them on a large scale.

Spring Hill Mines, No. 1 Slope.—"This slope is now down a distance of 2,609 feet by the new lift lately finished, and the levels are extended and balances driven up to the 1,900 feet lift. The west levels are being advanced, and the coal between them and the "Stony" level is worked long-wall. The lodgment at 1,300 feet lift has been repaired and a dam four feet thick, built with lime and cement, 200 feet inside the pump, allowing them to extract the 200 feet barrier which was formerly left to prevent the waters from flowing down into the lower lift. The principal work done on the east side of the back seam has been drawing pillars; on the west side, the level has been advanced and balances driven up to the lift above. The new sinking has been opened up with travelling slope and pipe slope and

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levels turned away. The new lift is 1,000 deep. In the month of September work was begun to introduce the system of haulage by tail-rope in this mine. The engine-house is finished and other branches of the work progressing. The following are the lengths of haul in different sections: On 1,900 feet lift, west side east seam, 4,000 feet; east side, same seam, 1,000 feet; west side, back seam, 4,400 feet; east side, back seam, 2,500; and on the 2,600 feet lift, west side, 1,500 feet, east side 1,000 feet. The pipe head has been widened to 8 feet and retimbered with iron booms, and the mine board in west side has been stripped and retimbered with heavy timber. A large amount of extra work had to be done in this mine during the past year, caused by a fault which had to be cut through both on old lift and new lift, and the turn-outs had to be lengthened (which was chiefly stone work) to render them suitable for the tail-rope system.

No. 2 Slope.—"The bulk of the work done in this mine for the past season was drawing pillars, principally on the 1,300 feet lift, and so far they have been won very clean. There is still a large amount of this work before the standing work will all be let down; to the rise of the Stony level it is worked long-wall successfully. On account of the presence of black damp, some trouble was experienced in drawing some of these pillars, but little or no fire damp has been met with in this mine. They began working the pillars from inside, and working back towards the bottom. In the month of June, preparations were made to introduce the tail-rope system of haulage, the engine is placed and the engine-room finished, and the other work is nearing completion. Following are the lengths of haul in the different sections:—Stony level, 4,000 feet; east side west slope seam, 4,000 feet; Jig-wheel, 400 feet; New seam, 1,000 feet. The levels will be extended on the west side of the mine, both in the new seam, so called, and Stony level. The principal work in east side on this lift will be pillar working. It is not likely that the new lift will be worked to any extent for the next year.

No. 3 Slope.—"This slope has, I think, the largest daily output of any mine in my district, there being daily drawn up from 1,000 to 1,200 boxes. The seam varies in thickness, and different systems of work are carried on to suit this. On the east side at 1,300 feet lift it is worked long-wall. On the west side, same lift, the levels are being extended and back balances driven up to next lift with the bords advancing, and there are sets of men coming behind drawing the pillars; in the lower lift the work is the same long-wall on the east side, and bord and pillar on west side. They are sinking the slope for another lift. In the month of April, preparation was being made to introduce

the tail-rope system of haulage and completed in the early part of COAL.
October, and on the 10th of October began to work on both sides of
1,300 feet lift.

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"The length of haul, on west side of 1,300 feet lift, is 5,000 feet; in east side, same lift, 2,500 feet; on the 1900 feet lift, west side, 3,000 feet; and on east side, same lift, 2,000 feet.

"Nos. 1 and 2 slopes have been connected overground by a trestle-work 597 feet long, an average height 50 feet, on which are one full road and two empty ones. An engine is placed in position to run an endless chain conveying full boxes up the grade, and also an endless rope on the empty roads.

"A double revolving screen 33' x 42" has been erected at No. 2 slope for screening coal for both slopes. Connected with this screen are two sets of elevators and one set of conveyors, also 5 coal bins which hold from 300 to 400 tons of coal. These bins are all lined inside with iron. There will be 3 engines in use at the Springhill Mines for tail-rope haulage of the following dimensions:

"Size of cylinder, 16"x20"; Drum barrel, 5 feet diameter; face, 2 feet; depth of flange, 6"; 4 drums, 2 for hauling and 2 for tail-rope; engines geared 3 to 1 of the drums; average steam pressure 70 lbs.

"*Minudie Mine.*—Not much work has been done at this mine for the past 5 or 6 years, excepting for a few months in winter season, and then the work was done along the crop, there being a water level giving them nearly 100 feet of coal. The slope has been sunk 200 feet below this water level, and the owners have decided to work the mine, and engaged Frank Burrows as manager, and at my visit in December 19th the water was nearly out. I understand it is the intention to work this mine on the long-wall system, for which it is well adapted, as there is about 4 feet of coal with 9 inches of fire-clay in the middle of the seam.

Crookshank's Mine.—"This mine is sunk some 200 feet on a seam of coal from two feet thick upwards, and partially worked long-wall. There are only from 15 to 20 men employed as yet. The arrangement for ventilation is very good, two air returns being driven to the surface. Mr. Burbine is under manager, and James Baird, Esq., is general manager of this mine as well as the Joggins.

Saltsprings.—"Some little work has been done in this mine during the summer. About eight men were employed, and they sank down in the seam 100 feet or more. The coal lays at an angle of from 75° to 80°. The work is stopped at present. They have erected an engine and pump, and are in a fair condition to develop the mine.

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Joggins Mines.—"This mine has been worked very successfully, long-wall, during the past year. A new lift of 420 feet has been sunk in the long-wall system. The sinking was started on the east side, about 200 feet from the slope. The landing place was 30 feet wide, and cogs or butts were carried down on one side and sets of men started on the other side and worked until the pipe-head was reached. Then the cogs were made somewhat larger and the pipe-head won out. Then the main slope was next won out and so on until the lift was put down 420 feet with pipe-head, main slope and travelling way. The coal has all been taken out in this lift and the entire section resting on packs.

"A place is now being driven to the surface for an airway for the east side, and a place is being repaired up through the old works for an airway for the west side, and the present airway will be for the new lift. During the year the second track has been laid in the slope. This, with the new lift, will give the management an opportunity to increase the output. Two new boilers have been put in, a new engine house, 42 x 24 feet, and the engine moved into it. A new office has been built, 36 x 32 feet, of latest designs.

Lawson Mine.—"This mine was abandoned last June, very little work having been done in it for the preceding part of the year.

Chignecto.—"This mine worked for two, or three months in the winter, about six men being employed, and has remained idle ever since.

Pictou County.

"The sales were 405,457 tons as compared with 405,096 tons in 1891.

"The home sales were 256,545 against 265,098 tons in 1891.

"The province of Quebec took 97,334 tons compared with 63,219 tons in 1891.

"The output of the Acadia Company was 250,847 tons, and of the Intercolonial Company 196,903.

"The operations of the Acadia Coal Company in reopening the Foord pit were being continued with favourable prospects until near the close of the year, when fire was discovered in close proximity to the new workings. As a precautionary measure, the men and horses were withdrawn and the pits sealed. As the indications of fire increased, water was admitted from the river, and at present the work of reopening this valuable seam is suspended.

McGregor Pit, Stellarton.—"This mine was worked up until the 24th August, but was idle from that date to the 1st December. The new

balances spoken of in last year's report have been completed, and one COAL almost worked out. The work being done at present is principally on the south side of the mine. This pit has the largest volume of air in circulation in any one mine in my district, and is to all appearances, now safe and comfortable. The present grasp of the coal is getting somewhat circumscribed, and cannot well be enlarged unless they sink, which may not be advisable until some more pillars be taken out, a proceeding which will be attended with grave responsibility both to life and property, as this is the lowest seam worked in this basin, and the overlying seams are all more or less on fire.

Third Seam Slopes.—"The balance on north side mentioned in last year's report is still being worked and the levels extended for other balances, which is all the work being done in this seam. The south side has been worked very little this year. The cage pit seam is being worked by way of the tunnel from third seam, and the levels extended north and south considerable distance and balances driven up. As the old works of the cage pit are to the rise, the balances are at the first short, but now the level on south side is advanced sufficiently far to where the balances may be driven up hill several hundred feet more. This will increase output and lessen expenses. The four-foot seam which is cut by the same tunnel is being worked long-wall, and under this system a most magnificent percentage of coal is being won. It is a beautiful coal and a mine easily ventilated. There is a connection from this seam into the drift leading from the cage pit into the Foord pit. The work in those three seams has been very fortunate.

English Slopes, Stellarton.—"At the English Slopes they began sinking in February, and in May it was found necessary to increase the ventilation, the means previously employed being a steam jet. A small blow-down fan was then erected, which gave from 7,000 to 8,000 feet of air per minute, and as but 2 places were sinking, this would seem to be sufficient, but during the summer months it was found necessary to stop sinking. The water for generating steam became scarce and the gas on indicator read from 1 to 3 per cent. They remained idle for two or three months. It is intended (or was), to connect these slopes with the Foord pit. The tunnel from the Foord pit being very fiery during the summer months it became necessary to suspend operations for a while. If it had not been for those drawbacks, the connection would in all probability have been accomplished. These slopes are now down 2,800 feet, their estimated distance, and the tunnel from Foord pit, is within 100 feet by estimation.

Foord Pit.—"The slants I have previously reported as being down a distance of 400 feet, were continued down to a distance of about 1,000

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feet, where a fault was struck. Several bords were turned off and some very good coal extracted. During the season there were signs of fire at the bottom of the old fan shaft. It was at once damped down and work on the south side of the mine stopped and the men put to work on the north side. Several places have been driven through into the old workings, and in one of them, in August last, at a point 300 or 400 feet to the rise, the temperature was from 95° to 98°. Operations continued on fairly well until the 11th of November, when some of the men discovered very high temperature at a point 300 feet from the bottom of the shaft, about 240 feet to the rise, and on the 12th November, when I visited the mine, I considered the fire was overhead in the old workings, and the management talked over the advisability of putting boreholes through the umbrella roof to ascertain if the fire was local or if it was the old fire coming down hill. However, on the 23rd of same month, smoke was observed coming through the cribbing of the shaft, and not knowing how near the shaft the fire might be, all the men were sent up out of the mine, also the horses, boxes and tools, and at my visit on the 24th, I found the mine damped down. A few days subsequently, a consultation was held between E. Gilpin, Esq., Inspector of Mines; H. S. Poole, Esq., General agent; Mr. Wills, manager, and it was agreed that it would be best to let the pit stand damped down as it then was, until the water would fill in to the top of the arches at pit bottom. I visited this mine twice shortly afterwards, and the manager informed me that gas would fire at the top of the pit. On the 7th of December it exploded slightly. I saw Mr. Wills, who then told me he decided to let the water from East River run into the pit, which was done, and the water allowed to rise about 30 feet in the shaft.

Six Foot Seam, Thorburn.—"This mine worked on in its usual way until March, when Mr. Joseph Dakers resigned the management and was succeeded by Mr. J. W. Sutherland, of Westville, who began improvements by enlarging the intake airway from the 700 feet level to the 1,100 feet level and retimbering it, and also retimbering it from the 1,100 feet level to 1,800 feet level. He also had a new overcast made at 1,800 feet level to carry the air over the main level to mine bord. He then began sinking the slope, and on December 5th it was down 600 feet and still sinking at this point. However, there is quite a change in the angle of the seam, it would almost appear as if the basin of the coal seam had been attained, as the angle of the coal seam is inclined to rise 2° or 3° instead of dipping 14° or 15°. The coal has improved in appearance to the dip. The long-wall system has been stopped altogether, the management having reverted to the bord

and pillar system with back balances, and are now engaged driving up a balance on the west side from the 1,800 feet level to the 1,100 feet level, which, when accomplished, will shorten the return airway considerably. There have been two balances driven up on the east side making now three balances working on east side. The levels on the east side were driven up to a fault and stopped. It is very probable they will prove this fault during this winter. On the west side the coal thinned down to about three feet in the levels, which were then stopped. The main slope, from the 1,100 feet lift, has been laid with two tracks instead of one as previous, and otherwise has been put in good shape with new timber and new sills. The mine is in very good condition and been very clear of accidents, one of which, however, was fatal. No attempt has as yet been made to open up the McBain seam.

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Intercolonial Coal Mining Company.—"A very large amount of coal, during the past season, has been extracted from the large block of coal referred to in last year's report. Some of it is still there however. The pillar working has been very successful during the past year. There was another lift sunk some 400 feet, making the total length of slope now 4,100 feet on the northside at the 3,600 feet lift. The levels are driven to the boundary line and back balances driven up to the 3,000 feet lift. On the south side the levels are in 2,500 feet and are being still driven. Two back balances are driven up to the 3,000 feet lift on this side. The coal appears to improve as they go to the dip. Near the crop on the north side there was a considerable area of pillars standing, a large proportion of which were successfully drawn during the summer.

Scott Pit.—"There were nine or ten sets of men working in the Scott pit, but in October it was stopped and they started sinking the slants, but only drove a few yards when they met a downthrow of four or five feet. The coal then came in regularly and of extra quality for a few more yards when another downthrow of four or five yards was encountered. This is one of the reasons why the coal was not more quickly obtained in the drift. And also when the angle was taken at 3,000 feet, main seam, it was 20° , but as they advanced toward the second seam, the angle flattened, so that before the coal was struck it was only 15° .

"On the 8th December, the coal in the tunnel was fired by a shot of roburite, and it took considerable trouble before it could be put out, as there were present some very strong feeders of gas.

Acadia.—"During the past year this mine has been worked steadily. All the work on north side is long-wall, and a large percentage of the

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coal has been won. On the south side it has been worked, bord and pillar, and here, in mining the coal, they met with considerable trouble on account of the enormous pressure. The management have decided to try long-wall in this side for the balance of the work on this lift. I have previously reported on the nature of the roof they had to contend with, and I can only add now it is no better, whatever, worse. They have sunk another lift of 350 feet, making a total depth of 3,910 feet in the angle and about 1,700 perpendicular height. This, with bad roof and tender coal, will give some idea of what there is to contend with. This lift was sunk 9 by $7\frac{1}{4}$ feet, and before the lift was sunk it was found necessary to lift some bottom to permit the boxes to pass up and down. After the sinking was finished they were obliged to strip the top and lift the bottom and put on wooden packs to keep it open. This lift will all be worked long-wall. It is a very difficult matter to keep the return airways open, and on account of the great depth the temperature is very high. Gas is issuing as free as ever. Still with all these drawbacks, it is, and has been, almost free from accidents of any kind.

East River Area—John Muir and Son.—"During the year a portion of the block of coal in east side of slope was taken out, but sufficient left to support the slope. He has now resumed work on the west side of slope as usual. Some two or three men are about all that have been at work here.

Cape Breton County

'The total sales for this county were 923,869 tons, against 982,392 tons in 1891.

"The production and sales of the Collieries for the year 1893 were :—

Colliers.	Raised Tons.	Sold Tons.
Bridgeport.....	32,230	31,328
Caledonia.....	120,230	107,200
Gardner.....	41,636	39,485
Glace Bay.....	154,845	138,413
International.....	111,856	105,479
Ontario.....	28	28
Reserve.....	154,790	135,836
Sydney.....	189,994	164,078
Victoria...	121,638	108,332

"Some prospecting work was done at various points, but no details have been received by the department.

Sydney Mines.—"Extensive repairs have been made at this colliery COAL. during the year. In the main pumping shaft, 300 feet of cast-iron tubing have been put in place; in the cage slides, pump and pump frames have been renewed and 400 feet of pump rod put in place Discovery and development in Nova Scotia.

"The pulley frame of the main hoisting shaft has been strengthened by placing in position with the present frame string pieces of pitch pine timber. A speaking tube has been placed in the main shaft.

"The Queen pit upcast has been repaired from top to bottom, the old wood taken out and new wood put in. In the pit, the north side workings have been concentrated towards the dip, and all the coal hauled up the pump deep, from the lowest landing, which is 1,760 yards from the shaft, or 1,500 yards below the bank head.

"A slant road has been driven to the old Skinner's Section, by which the coal from there and old No. 2, will be run down self-acting. Below old No. 3, the submerged district, a branch has been started and working since last June; 200 yards below there a fine section of coal is won, and now in good working order with a very fine landing there. Also a double road is being laid from the bank head, 1,000 yards down this deep; in order to facilitate the haulage of the coal from the increased depth, a pair of 15-inch cylinders, a pair of 26-inch cylinder engines, are being built to supersede those now in use.

"On the south side of the pit the main deeps have been extended 300 yards below the large trouble, and a new landing made there which is now in operation; this will be the finest section in the pit, nearest the shaft total distance being 1,140 yards.

"Mr. John Greener has sunk a small shaft on his area through what is called the No. 3 seam, and has had a few men getting coal out of it during last winter, which was sold I presume for local purposes. I understand that work is resumed again there this winter.

Victoria Mines.—"Work has been very actively prosecuted at this mine during the present year. The west main slant has been extended and another lift of 600 feet gained, and a pair of both east and west levels are in course of being driven.

"The west levels are in about 350 feet, but no balance commenced yet.

"The management thought to abandon the 1,200 feet lift going west where they were taking out the pillars owing to the subsidence of the overlying strata interfering with their railroad.

"The east level in the 1,200 feet lift in the east slope is now about 4,200 feet in from the engine landing. One balance having been driven during the year, and 20 rooms won out; and another balance

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commenced near the face of the levels, which will in all probability be the last one in this section, as the cover thins out in this direction and would most likely admit water into the mine if continued much further.

"The east levels in the 1,800 feet, lift in the same slope are in some 3,000 feet and rising at an angle of 5°, this is driven so as the tubs will self act (on incline,) and thus do away with horses.

"Three balances are at present working in this district. I am informed by the management that it is their intention to bring all the coal out on the centre slope in the near future, for which preparations are being made, and three separate roads are being driven, one being intended for the haulage road with two tracks of rails, so that the engine will be assisted when bringing a full trip up the slope by the empty trip going down at the same time.

"On the east side of the centre slope a separate road has been driven for the steam and water pipe from the pumps, and on the west side of the centre slope a road is made, to be used as a separate way for the workmen travelling to and from their work.

"I might state that stoping has been successfully carried on during the shipping season and hardly any coal lost.

"The eight feet diameter 'Murphy Fan,' mentioned in my last report has been erected and is doing its work satisfactorily.

"The heapstead is being all covered in order to keep the banksmen dry during wet or stormy weather, and also keep the rain and snow from drifting into the mouths of the slopes during the winter season.

Lingan Mines.—"Two or three men have been working in this pit part of the summer, and raised about 160 tons of coal, which has been shipped to Sydney mines.

Gardner Mines.—"Work has been going on steady during the past year. Mining coal has been chiefly confined to the south side of the pit.

"The levels have been extended 400 feet and the headways about 300 feet. At the time of my last report the one level was used for haulage, drainage and return airway. Since, a lower level has been driven, and used for drainage and return airway, making a remarkable improvement. The water lodgment has been considerably enlarged.

"An incline road has been laid from the pit bottom to about 600 feet towards the rise where a breast of about 250 feet has been opened out and worked successfully by the Jeffrey electric coal cutting machine. A second incline is in course of construction which will be 1,000 feet in length, striking the face of the workings on the south side at a point about 600 feet to the rise of the level and will take the coal

direct to the pit bottom, relieving haulage by horse and largely COAL.
increasing facilities for getting coal.

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"On the surface many improvements are visible. A smoke-stack 60 feet long by 3 feet dia. made out of $\frac{3}{8}$ -inch iron has replaced the two smaller ones previously used. A tubular boiler 14 feet long by 4 feet with 6-inch dia. flues has been put in service. An engine of 10-horse power has been fitted and used for hauling coal from bank. A hot well has been sunk, from which boilers are being supplied.

"The old dwelling houses which were in a dilapidated condition have been all thoroughly repaired and tenanted by miners and their families.

Old Bridgeport.—"Mining has been confined to the south and rise of the south levels during the season. The incline road has been extended further to the rise and a new section of rooms opened out there.

International.—"There have been no new features of work in this mine during the year. No. 9, south levels have been extended seven chains, ventilation was good, and rooms and roadways well timbered. On the bank a slack bunk was built, 100 feet long by 28 feet wide, capable of holding 700 tons, from which the slack coal can be run into the waggons with very little shovelling.

"The bank frame and part of the heapstead have also been raised.

Little Glace Bay.—"During last winter a pair of deeps were started on the south side of the pit, and driven to the dip 866 feet, and levels broken off north and south and driven about 600 feet each.

"Rooms have also been opened up there, at the time of driving those deeps and levels it was found very difficult to keep up the roof, it would come down without giving any warning, a thickness of six feet in places and cutting along the pillar, and breaking close to the face. However, after the rooms were opened out, the pressure on the narrow places were relieved and the trouble ceased.

"An engine with a pair of cylinders 12 x 24 inches, is placed to the rise of the pit on the south side, by which the coal is hauled from the deeps, and then run back to the pit bottom.

"On the 1,800 foot headway where the coal used to be hauled by horses, it is now run by an incline road self-acting.

"A new hoisting engine has been put in place of the old one, with a pair of cylinders 18 x 24 inches, and drum 7-foot diameter, which gives good satisfaction.

Caledonia.—"Work has been going on in about the usual way. A section of pillars have been split on the high side of the east level. The

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new east deep has been driven 300 feet, No. 4 east levels extended about 280 feet, all the coal mined here this season was chiefly taken from the deep with the exception of the above mentioned pillar.

"An Ingersoll air compressor has been added to the plant size 20 x 30 inch cylinder, driving three coal cutting machines, one in the east deep, distance from engine 1,410 feet, two in the west deep 2,900 feet, they are giving good satisfaction.

"In addition to the improvements on bunk, a new smokestack has been erected, size 66 feet long, 3 feet $1\frac{1}{2}$ -inch diameter, steel plate. A new engine-house has been built, walls and floor concrete; also the boiler house and foundation has been rebuilt.

"A forge 100 x 28 feet has been built.

Gowrie Mines.—"The east side bank head heading was lengthened to give more room for a longer trip, nine boxes put on now instead of six as formerly. The east side has been driven 360 yards, at 250 yards below No. 2 east side levels. Three levels have been turned off south, and driven 150 yards, and rooms opened out there, and a fine landing made.

"The old levels above this on the east and west, have been extended as usual. A section is being opened up on the west side of the east deeps, north of the stone trouble, also on the west side of the pit.

"This section mentioned in my last report, north of the stone trouble, is still being worked, and about the same width of coal between that and the anticlinal.

"On surface, an Ingersoll air compressor has been added to the plant, size 16 steam and 20 inch air cylinder. A new pump, 12 x 12 steam cylinder and $5\frac{1}{2}$ -inch water end were placed in the new deeps. All the pumps are now driven by compressed air.

"The coal on the new lease was successfully prospected to the north-west of the down-throw fault with a Bullock diamond drill, and the seam 6 feet thick, proved and traced to the north-west boundary.

Caribou Coal.—"I did not notice much improvement at this mine since I visited it last season. It was at a standstill when I was there on the 1st of September last. There were only three men at work around the mine, two of them I presume attending the engine and pump, keeping the water out of the pit.

"A new Dean pump has been placed in the pit, 10-inch cylinder, 7-inch, and 5-inch plungers 18-inch stroke, double acting.

"The shaft was sunk about thirty feet deeper, and cage slides and buntings put in. A very good bank and pulley frame has also been erected.

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"I notice a great number of wharf logs and timber, at the shore for the purpose of being put into the building of a wharf. I was told by the manager there, Mr. Wilson, that the site was not yet settled, and was in dispute, owing to the parties who owned the water lots, and this was the cause of the mines being idle, but he hoped that the wharf would shortly be built and work resumed.

Reserve Mines.—"The heapstead has been covered and boarded in down to the slope mouth. The east deeps 300 feet, the south low levels extended about 200 feet. No work has been done in the west main slope since last report.

"A new pump has been placed in the drift, size 30 inches, stroke 9 inches, water 14 inches, steam cylinder. I am informed by the manager that the east drifts are to be driven to the boundary line, in this way a large area of coal can be won towards the south end of the reserve lease, as the crop of the coal extends south of the southern boundary line.

Emery Mines.—"Extensive improvements have been made at this mine during the year. An Ingersoll air compressor cylinder 20 x 30 inch, 2 boilers and 8 coal cutting machines, 1 new pump which pumps from the deeps, and an engine which hauls the coal from the deep workings, are added to the plant. Also, a boiler and engine-house have been built. The engine is placed in the pit to the rise of the shaft bottom, and hauls the coal up the deep, and it is there let back to the pit bottom.

"All the levels and deeps are driven by the machines except the two high west levels; the greatest distance that any of the machines are from the surface is 1,540 feet. Those coal cutting machines have given great satisfaction. The deeps have been driven 250 feet, the upper north levels 640 feet and the low deep about 700 feet.

"Prospecting has been going on pretty extensively during the last season in Cow Bay Basin, by Mr. Archibald and Mr. Landrie. Mr. Archibald succeeded in tracing the Gowrie, or an underlying seam 6 feet thick out to Morrison's lakes. I did not hear if Mr. Landrie struck the Tracy seam or not, but it is doubtful, as no reports of a workable seam has been made. Also, west of this considerable prospecting has been done on Mr. Murray's area, but it appears that the seams of coal there opened are small.

"It is reported within the last few days that a seam on the Louisburg Railroad, west of the Lorway seam, on Mr. Mossely's area has

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been opened. It is said to be 4 feet 11½ inches thick, also it is opened west of the Gardner Mines, western boundary line; it is said to be 5 feet thick there. I have no doubt but this is the equivalent of the seam that Mr. McVey showed me a year ago west of the Lorway, on the southern line of the McColl area. At this point the seam was found to be 4 feet, 6 inches at the crop. Also prospecting has been prosecuted west of the Lingan Low Point Basin, by the Messrs. Routleges, with a diamond drill, driven by steam, but I have not learned that they struck any seam worth notice."

Mr. Hugh Fletcher of the Geological Survey was during 1892 engaged in field work in Cumberland County, and in his summary report of work done that season (p. 43) he mentions the occurrence of thin seams of coal on a brook near Salt Springs as follows:—

"Through the kindness of Mr. J. R. Cowans, we obtained plans of the levels, slopes and faults of the working on the three coal seams at present mined at Springhill, to supplement investigations made by Mr. Scott Barlow and Dr. Ells in former years. In this extension, north and south, the workings have not passed beyond the ground proved by Mr. Barlow, but interesting questions have been suggested by the workings to the deep. Records of deep borings in this field, furnished by Mr. R. P. Fraser, Mr. James Baird and Mr. Wm. Hall, will also prove of value in the determination of the structure. In the little brook that flows past the station at Saltsprings and about 1,000 feet from the Intercolonial railway, a small seam of coal has been opened by a shaft or slope more than 150 feet deep, the inclination at the surface being vertical but flattening to 66° and the direction being 305°; while nearer the railway, the dip varies from 55° to 39°. At a depth of forty-five feet an adit connects the shaft with the brook and lower down a level has been driven north-eastward a considerable distance. The coal is irregular in thickness, being in one place, it is said, seven feet.

"The section on the brook is as follows:—

	Ft.	In.
1. Red argillaceous shale with bands of gray sandstone.		
2. Coaly shale with a streak of coal.	3	0
3. Greenish, crumbly argillaceous shale, of considerable thickness.		
4. Soft argillaceous shale with rootlets.	1	10
5. Coaly shale and clay in thin layers.	0	6
6. Good coal.	2	0
7. Clay with rootlets.	0	7
8. Coal, somewhat impure.	1	8
9. Soft argillaceous underclay.		

"This seam is supposed by some to be the 2 feet 6 inch seam worked at Sand Run mine, and on the Springhill and Oxford railway and shown on Mr. Barlow's map. The thickness, however, is greater and the roof is different. COAL
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"In the small brook about a mile east of the Styles mine and 100 yards west of the Economy road, two seams of coal ten feet apart, very irregular in thickness and impure in quality, according to Mr. McCarthy, but containing ten inches of good coal, have been lately opened, at what is called the Stanley mine, in several small shafts, the measures dipping at an angle of 45°."

NEW BRUNSWICK.

The production of coal in this province amounted to 6,768 tons valued at \$9,375, and was as in the past the result of operations in the vicinity of Grand Lake in Queen's and Sunbury counties. These operations are of a desultory character, the work being largely done by the farmers between their more busy seasons. Discovery and
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Mr. Robert Chalmers, of the Geological Survey, in the Summary Report for 1892, (p. 37) writes as follows of a recent discovery of coal in Gloucester County :—

"The discovery and opening up of a coal seam in the eastern part of Gloucester County, N. B., on the south side of the Baie des Chaleurs, having been reported, I visited it late in the season. The coal crops out in the bank of a small brook on a road leading south from Upper Caraquet, and about four miles and a half distant from that place. A trench cut into the bank exposes the coal seam, which is sixteen inches thick, and has another thin seam overlying it, with a parting of fire-clay between them. A short distance farther east a shaft has been sunk, but was partly filled with water on the occasion of my visit, and I did not see the coal seam there. The workmen, however, informed me that it was somewhat thicker than where I measured it; and in the heap of coal on the bank taken from this opening, the quality seemed better, that is, the coal was harder and came out in larger pieces. The dip of the seam corresponds with that of the sandstone strata, being 5° to 10° eastward, and consequently the thickness of rock overlying it becomes greater in that direction."

NORTH-WEST TERRITORIES AND MANITOBA.

The production of coal in the North-west Territories during the year amounted to 184,370 tons, valued at \$469,930, an increase over the previous year of 10,239 tons and in value of \$32,687. Regarding the Discovery and
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In the Summary Report of the Geological Survey Department for the year 1892, (p. 7) the director writes as follows of two visits made by him to coal deposits in southern Manitoba :—

“ On the 20th July I visited section 11, township 2, range 23, on the flank of the Turtle Mountains, south of Deloraine. On the north-west quarter of this section, the owner, Mr. Duncan McArthur, has sunk several shallow pits, and a shaft 23 feet deep, in which he states three seams of lignite coal were found with intervening clay strata.

1st seam at 17 feet	2' 6"
2nd seam at (?)	2' 6"
3rd seam at 23 feet, thickness not ascertained.	

“ All the workings were full of water at the date of my visit.

“ From the specimens of the lignite shown me by Mr. McArthur, it appears to be of similar quality to that now being mined at Estevan, and would certainly be a valuable fuel for local use if mined and sold at a reasonable figure.

“ These are doubtless the same seams as those described in the Geological Survey Summary Report for 1890, page 10, as having been opened in range 24, township 1. It was then stated the seam would probably be found from range 19 to range 34, in township 1. It is now proved that they extend in places at least a mile into township 3, or thirteen miles north of the international boundary.”

* * * * *

“ At the Hassard mine, fourteen miles from Estevan, a very fine seam of lignite has been opened, and above it at the same point, there are three seams as under :

1—4 feet	12 feet below prairie level
2—2 feet	40 do do
3—1 feet	50 do do
4—8 feet	80 do do

“ This eight-foot seam is only a few feet above the level of the Souris River, and being covered by debris and superficial deposits, was not seen either by Dr. Dawson, in 1874, or by myself in 1880. The Hassard mine is on the left bank of the Souris river, section 4, township 2, range 6, west of second meridian. The seam presents a solid tough lignite eight feet thick and of excellent quality. It is somewhat difficult to correlate the above section with that at the Estevan

mine, but it seems quite unlikely that the eight-foot seam at Hassard's is, though thought to be so, the same seam as that now being worked at Estevan, and, as the latter is only 28 to 30 feet below the prairie level, it seems much more probable that it is the same seam as the six-foot seam shown in the figure, page 7 A, of the report 1880, above cited, and also as the seam in the old Sutherland mine, page 5 A of same report, in which case the Hassard seam would be below the bed of Long Creek at Estevan. In any case, there is an enormous quantity of available fuel in this field. In estimating the quantity in 1880 it was stated " :—

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" "It may be assumed that there are in this region above the level of the Souris river at least eight feet of available lignite coal, over an area of not less than 120 square miles. This estimate would give 7,136,864 tons to the square mile, calculating the cubic foot at only 64 lbs."

BRITISH COLUMBIA.

We have unfortunately to report a falling off in the coal industry in British Columbia during 1892, the decrease in production compared with that for 1891 being 227,093 tons, as may be seen on reference to the following tables 12 and 13, which are compiled from figures afforded us by the Provincial Department of Mines :—

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TABLE 12.

PRODUCTION, SALES, ETC. FOR 1892.

Name of Colliery.	Coal Raised.	Sold for Home Con- sumption.	Sold for Ex- portation.	On hand Jan. 1st 1892.	On hand Jan. 1st 1893.	Number of men employed.
	Tons.	Tons.	Tons.	Tons.	Tons.	
Nanaimo	485,392	145,632	344,538	9,949	5,171	1,367
Wellington.....	325,216	62,789	267,008	11,760	7,177	815
E. Wellington ..	37,688	5,992	31,360	.....	336	152
Union.....	77,199	5,356	74,542	15,523	12,824	520
Total ...	925,495	219,769	717,448	37,232	25,508	2,854

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TABLE 13.

PRODUCTION, SALES, ETC. FOR 1891.

Name of Colliery.	Coal Raised.	Sold for Home Con- sumption.	Sold for Ex- portation.	On hand Jan. 1st 1891.	On hand Jan. 1st 1892.	Number of men employed.
	Tons.	Tons.	Tons.	Tons.	Tons.	
Nanaimo	590,751	157,652	429,952	6,802	9,949	1,464
Wellington	386,604	61,291	316,346	2,794	11,760	957
E. Wellington . . .	46,666	7,748	40,523	1,605	.....	188
Union	128,567	329	116,435	3,720	15,523	585
Total . . .	1,152,588	227,020	903,256	14,921	37,232	3,194

The following details, also taken from the report of the Minister of Mines will afford a very fair idea of the development and present condition of the industry during 1892 :—

“The exports of coal by the same collieries in 1892 were 640,579 tons, as follows :—

Nanaimo Colliery,	export	307,623 tons.
Wellington Colliery,	do	238,400 do
East Wellington Colliery,	do	28,000 do
Union Colliery,	do	66,556 do

Total coal exported in 1892	640,579 do
Add home consumption in 1892 . .	196,224 do 5 cwt.
Add on hand 1st January, 1893 . .	22,755 do 15 do

859,579 do

“The ports of shipment are Nanaimo, Departure Bay, and Union, near Comox ; and the foreign shipments were exported chiefly to San Francisco, and lower ports in California, United States. Coal was also shipped to Alaska, Petropavloski, China (per C.P.R. steamers), and to the Hawaiian Islands. H. M. navy and United States war vessels have been supplied with coal for fuel, and, as usual, ocean mail steamers and vessels calling for fuel have received supplies at the several shipping wharfs.

“Owing to an over supply of cheaply produced coal, from countries COAL. recklessly competing with the collieries of the Pacific Coast (commonly called the Coast collieries—including Vancouver Island and the Puget Sound coal mines—the natural sources of supply), in the California market, the coal proprietors here wisely restricted their output of coal during the year 1892, and lessened the exports to that State by about one-fifth of last (1891) year's production and shipment, so that the main totals are correspondingly less in amount for 1892. This apparent falling off in trade should not be regarded as retrogressive, but, as it really was, viz., the result of prudent and far-seeing policy on the part of the managers of the coal industry of this province, and at the same time an evidence of their stability and financial strength in commercial emergency. Foreign trade has revived, and the output of coal is regaining its former volume and activity.

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“In the year 1892, the coal which entered the port of San Francisco and lower ports in California was supplied from the following sources :—

British Columbia	425,170 tons.
Puget Sound	362,160 do
Oregon	24,170 do
Alaska	1,450 do
Eastern	34,260 do
Australian	240,542 do
English	146,909 do
Scotch	21,700 do
Welsh	50,575 do
Japan	3,530 do
Mount Diablo	42,000 do

Total at San Francisco in 1892 . . 1,352,466 do
Amount of coal received at lower ports,
viz., San Diego and Wilmington . . . 158,600 do

Total of coal received in California
in 1892 by water routes 1,511,066 do

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Nanaimo Colliery.—*No. 1 Pit, Esplanade, in Nanaimo.*—"This mine, being part of the large works known as Nanaimo colliery, belongs to the New Vancouver Coal Mining and Land Company, Limited, and has now proved to be a most valuable mining property, and at present no estimate can be made of the extent of the field of coal yet to be worked. This shaft is 650 feet deep, and as in previous years, the workings are what is called No. 1 North Level. About 50 yards in this level, from the shaft, there is a slope driven eastwardly for about 1,000 yards, and at 600 yards down this slope, there is the No. 3 North Level, which, as its name implies, is worked in a northerly direction. All the workings are under the water of Nanaimo Harbour, with a rock and débris between, varying in thickness from 600 to 700 feet, so that the workings are quite safe from any influx of water, considering that the rock is mostly hard. The workings are on the pillar and stall system, and the pillars (coal) are large.

"The workings of No. 1 North Level extend under the Nanaimo Harbour and Protection (or Douglas) Island, and this level, with its windings, over two miles in, is the longest underground hauling road of any colliery in this district. For the long stretch of about 2,000 yards, the coal has been regular and very good, with an average of about six feet thick, overlaid mostly with a good hard roof. For the distance above referred to, all the workings have been to the west side, and much of this is not started away from the level. On the east side, it is all solid for the distance mentioned, excepting the slope run down to connect with Protection Island shaft, described in a former report.

"No. 3 Level is also in good coal, although they have had considerable trouble with faults, yet there has been a large amount of coal got from this district of the mine during the past year. This level is now in the same area of their field that they have been, for the last three years, working in the No. 1 north level, but a great distance to the east of No. 1 level. The coal is eight feet thick, the quality and appearance being the same as in No. 1 level.

"Ventilation is good. When I was down in December, 78,000 cubic feet of air were passing per minute, for the use of 170 men and 23 mules. The ventilation is conducted on the separate split method. The No. 1 level being ventilated from Protection Island shaft, from which comes a current of 45,250 cubic feet per minute—23,250 going to one division, where there are 57 men, and 22,000 to 59 men.

"No. 3 level is ventilated from No. 1 shaft, thence down the main slope to the level. By this way 32,750 cubic feet pass per minute for

use of 54 men, and the mules that may be at work in the different districts.

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"The motive power is a large Guibal fan, erected during the past year. It is 36 feet by 12 feet, giving the above result with 34 revolutions per minute,—water gauge, $1\frac{5}{16}$ inches. It can be safely worked up to 60 revolutions per minute, if required. This is a great relief to both the manager and the men. The former knowing that he can give when required, and the men being satisfied that they can have, all the fresh air needed, as there is a considerable quantity of powder used in the mine. The shots are fired at regular times, and at those times, with all the air, it is smoky for a while. Very little gas is now found in this mine, and the mine is also free from dust.

"Up to last year the mode of hauling in the levels was by mules ; now we have got a new motor, for this out-of-the-way country, namely, electricity. The New Vancouver Coal Company, being the first in this province to try this mode of hauling coal in their extensive mines, made arrangements with the Edison General Electric Company to supply them with steam engines, and all the electric plant, to haul the coal from the No. 1 and No. 3 levels in this mine. The dynamo is fixed on the surface, driven by a steam engine built for that special purpose—this is about 100 feet from the pit's mouth. The engine, or power house, is an imposing building. From the dynamo the current is conveyed to the switchboard, when it thence passes through the different instruments for measuring the current, and cut-off—to protect the plant against danger, if the current should become accidentally too great ; thence the current leaves the power house to go under the ground. There are two copper wires strung up ; one of these is insulated, and the other uncovered—this latter is the one for the trolleys to run on, and supply the power to the locomotive ; the insulated wire supplies the power in case of a break in the other, and also works in connection with the other at all times. These wires are strung in No. 1 level for 2,600 yards—this being the distance that the locomotive goes, travelling at the rate of six miles per hour ; and it is no unusual thing for one locomotive to take along 60 tons at a time.

"There are three locomotives ; two of them are of 30-horse power, and are of eight tons each ; the other is not so large, being of 15-horse power—this was the first to be used, in the No. 3 level. The electric locomotives appear to work very well, although I think it would improve their working qualities if they had a straight road to travel.

"The bottom of the shaft and about the sidings are lighted up by the electric spark, making it almost as light as day, and a great improvement on the oil lamps.

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"Strangers coming to Nanaimo by steamboats or ships may not know, when they are entering the harbour, that from 600 to 700 feet below them there is one of the busiest workshops in British Columbia. On all the shifts there are nearly 400 men and about 40 mules, besides steam engines, pump (worked by compressed air), and three electric locomotives—all in motion; and much of these works lighted by electricity.

No. 3 Pit (Chase River), Nanaimo Colliery.—"This mine of the New Vancouver Coal Company has, with the exception of about two months in the summer, not been operated; only the pumping being done. Not for want of coal in the mine, but owing to the over-stocked state of the coal market.

Southfield Mine, No. 1 and No. 2.—"This once great producing mine of the Nanaimo Colliery has had much idle time during the past year, owing to the want of demand for coal at prices that would justify the company to put their coal from this mine on the market. The output of coal per day is much reduced here: all the coal taken out being from the pillars (coal).

"Ventilation is very good; the last time I was down, in December, there was a volume of 81,220 cubic feet of air passing per minute, for the use of 40 men and four mules. This was travelling well around the pillars and old work. There is no gas found here; the mine is also free from dust.

No. 5 Pit, Southfield.—"This mine also belongs to the New Vancouver Coal Company. The shaft is to the dip of Southfield (Nos. 1, 2, and 4) mine. Coal here is of a very good quality, but not so regular as might have been expected; at some places it will be twelve feet thick, and in other places quite thin: although there is plenty of coal on an average to make a good seam. It is improving that way, and it is to be hoped it will continue so.

"Ventilation is good; motive power, a fan, worked by a steam engine. When I was last down, there were 24,000 cubic feet of air passing per minute: this in two divisions at the bottom of the shaft—one to the east, and the other to the west side, and for the use of forty-two men. This mine gives off some gas at times, but with ordinary care there is no danger of accidents.

"At this mine they have got good, substantial pit head gear, and all appliances for the same, together with railway sidings; all in connection with their system of railways having access to the company's shipping wharfs—everything complete to handle a large output of coal. There

is quite a large tonnage coming out at present, and at no distant day the tonnage and prospects of this mine may far exceed the No. 2 Southfield mine when in its best days.

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This (No. 5) mine is in connection with what is mentioned in a previous report as No. 4 slope, and which is now an out-way for No. 5 pit. There is no mining being done in No. 4.

Protection Island Shaft.—"This is also the property of the New Vancouver Coal Company, and is put down in South Point of Protection Island. It was finished to the coal on the 12th January, 1892, at the depth of 670 feet, this being where they found the continuation of the coal worked in No. 1 pit. As they anticipated, it was found to be five feet thick, clean and good. Without stopping to make the necessary fittings required at this stage of the work, such as permanent large engine (which they had on the ground), pit head gear, etc., they went to work at the coal to get connection with the slope that had been put down 300 yards below the No. 1 level of No. 1 pit, on the 22nd January. Only ten days after they had finished sinking they holed through on the slope mentioned. Now they were able to travel under the harbour of Nanaimo for nearly two miles, coming out to daylight in the city of Nanaimo.

"All the works being in order, the company knowing that the lower seam, which is about seventy feet below the Douglas seam (worked in No. 1 pit), had been good in some places where it had been worked, and the Protection Island shaft not being near any large known faults, it was settled that they would deepen the shaft to the lower seam. The rock was hard, but they were successful in reaching the coal on the 13th April: the rock between the two coals being sixty-two feet, with the coal underneath four feet thick, very hard; and having burned some in my house, and paying particular attention to it, I am not afraid to say that it will prove itself, by those that will use it, as a first class household coal. The company is now driving a slope to the dip, and I am pleased to be able to say that it is somewhat improving in thickness.

"This is a valuable discovery for the province, to the people about Nanaimo in general, and to the New Vancouver Coal Mining and Land Company, Limited, in particular, as it is to their energy and perseverance that this has been achieved; and it is the general wish that the reward of the company will be great. There is not a great deal of this new seam opened out yet, but doubtless there will be a good account of it given at the end of the year.

"In reference to the Douglas or upper seam, they are opening out this fast, although not sending out anything like the quantity of coal they could do, as they would have to dump it on the ground. The

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company is, however, building a very large wharf near the south point of Protection Island, and about 400 feet from the mouth of the shaft. At this wharf the largest ships will be able to tie up and get their load. To all appearances they will be able to take ships here before the middle of February ; then they will increase the output, and I hope they will have plenty to send out for many years to come.

Northfield Mine, Nanaimo Colliery.—"This mine is mentioned in previous reports and belongs to the New Vancouver Coal Mining and Land Company. This mine is entered by a shaft, as are all the mines of the Nanaimo Colliery, except the No. 2, Southfield. The workings from Northfield Shaft are by levels, from the north and south sides, with a slope on the north side. It is from this slope that the greatest amount of coal is taken. The mine is worked on the long-wall system ; the coal having a varied thickness of from two to four feet. As in all the mines in this district there has been much idle time, owing to the market being overstocked ; but where the article that takes best is mined, there they have generally the most work, in such times, and this has applied to Northfield Mine during the past year.

"The coal, being hard and of a good quality, commands the highest price both in Victoria, B.C., and in the California market, and in any other place where it may have been introduced."

"Ventilation is good. Motive power is a fan driven by a steam engine.

"There was a current of 40,560 cubic feet of air passing per minute, for 112 men and twelve mules. The separate split system is used in this mine. The current is divided into two divisions at the bottom of the shaft—one to the north and the other to the south side—that to the north goes down the slope, and from the slope, where it is again divided, one current to the west, the other to the east side, getting at the lowest point, where it ascends, taking the face of the coal as it goes along. As there is quite a large quantity of powder used, shot firing comes at stated times. The firing causes it to be quite thick, but is soon goes past. The three divisions of air do not all join until they get to the fan or upcast shaft.

"Little or no gas has been found in this mine. It is also free from dust.

"In each of the mines of the Nanaimo Colliery there is a monthly examination by a deputation of the workmen, who are thus able to see the condition of the mine. The result of their finding is recorded in a book, and also posted up in some conspicuous place, where all may read it.

Harewood Estate, Nanaimo Colliery.—"As mentioned in my former report, this large estate, now the property of The New Vancouver Coal Mining and Land Company, is being explored for its coal beds. The shaft that was referred to as sinking did not turn out as well as the bore hole had indicated, although the coal that was got is very good and hard; for the present it is at a stand-still, but the company continued the prospecting in another place. At this new place the crop out of the coal is found, showing some very good coal. When I was out there lately they had got a slope in 100 yards, and at the face the coal was three feet thick; in driving this slope, in some places it was found to be much thicker. The coal lying at the slope head looks very well, and when burned leaves a small percentage of fine reddish brown ash. The company is doing considerable work to prove this property—to find out an estimate of the value of its coal-bearing area, and its consequent prospect as a coal field. Although at some distance from their railway, yet when it is decided that the coal available will justify them, railway connection can soon be made, and it looks as if the coal now being worked would justify the opening of works at Harewood.

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Wellington Colliery—No. 1 Pit.—"This shaft is near Departure Bay, and was referred to in a previous report as having been put down fifteen years ago. Excepting a little coal got out of an upper seam (corresponding with a thin seam now being worked at East Wellington), no work was done.

"This shaft of early days being small, it has lately been enlarged to the usual size of shafts owned by Messrs. Dunsmuir & Sons, viz., eight by eighteen feet, timbered throughout with 4-inch plank, excepting about sixty feet at the top, which has got walls of twenty inches of timber and six inches of cement to keep out the surface water. Before they could sink this shaft they had to erect a large engine, and put up the permanent head gear, then they were able to accomplish the work of putting this shaft down 300 feet, which is the required depth of the Wellington coal. They have started mining at the upper seam of coal, leaving the lower seam for another time.

"This upper coal is about three feet thick and of good quality. Close on the top and between the coal and the hard rock there is a bed of fire-clay, five feet six inches thick; then below the coal they have four feet of soft black dirt, and next comes a solid bed of fire-clay, twenty-eight feet thick, making altogether thirty-three feet of most valuable fire-clay, an article that has been much sought after in this country. The Messrs. Dunsmuir & Sons, although not manufacturing it themselves, have sent a quantity of this fire-clay to the

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British Columbia Pottery and Terra Cotta Company, some of which has been made into brick for use in Her Majesty's war-ships on this coast, which brick has given great satisfaction, and compares favourably with any that is imported from England. The proprietors of this shaft are working with all haste to get the railroad from the shaft connected with the Wellington Railway. This will be done in about two weeks, and then the British Columbia Pottery Company will be able to obtain all of this fire-clay that they may require.

No. 3 Pit, Wellington Colliery.—"There has not been any mining done here during the past year, yet there is a large quantity of coal to be got out from this pit.

No. 4 Pit, Wellington Colliery.—"This pit is about 1,000 yards east of No. 3 pit, and is connected by a good way with the same when the water is out. Here, as in all the mines of this colliery up to the 13th September, there has been much idle time, owing to so many shipments of cheap coal coming from Australia and England to California, our principal market. This mine was working up to the above date whenever there were ships to take the coal, and everything was in the usual good order at that time, when the fireman in travelling in the airway near the up-cast shaft discovered a strong smell of something distilling or burning (heating). The fireman reported directly, and on tracing it out it was found that the smell came from the place where they had been taking out pillars (coal). All the time while the pillars had been worked no fire had been seen; but Mr. Bryden, the manager, with his usual caution, gave orders for all the men to take their tools out, and the mine cars and mules were sent up. Some men were kept to put in extra timbers where they thought it necessary. This was done in case they had to flood the mine. There was also a large force working in the vicinity where the heating was going on, until on the 18th September, when active fire was first discovered; then Mr. Bryden gave orders for all the men to get out of the mine, and the No. 4 pit and its fan-shaft were sealed taut, excepting a small 4-inch pipe-test hole. Mr. Bryden not wishing to run any risk of an accident to the men by working in the mine to endeavour to subdue the fire, decided to flood the mine, so a connection was made by a drain from the Millstone River, and the water run from there into the mine, and in the early days of December both No. 3 and No. 4 mines were filled with water, and it was left that way until January of this year, after which it will take a long time to take the water out of the mine.

"Through the fire and the flooding of this extensive mine 200 men were thrown out of places, but the manager did his best to give as

many as possible work in the other pits, where with considerable in- COAL
convenience they found most of the men work. Now the coal trade Discovery and
has somewhat revived, the output from No. 4 pit is greatly missed, as development
it was the most extensive mine of the Wellington Colliery. In a short in British
time, however, it will again be in full operation. Columbia.

No. 5 Pit, Wellington Colliery.—"This mine is yet the only mine of the Wellington colliery that has connection with the Esquimalt and Nanaimo Railway. The cars of the railway company run to the mine chutes, receive the coal and carry it to Victoria, saving handling and breakage. To this mine Messrs. Dunsmuir & Sons have extended their own railway system, connecting with their shipping wharves at Departure Bay. In this pit there has also been a lot of idle time during the past year. The same cause applies here as at the other works, viz., the California market being filled with cheap coal from other countries, but at the close of the year trade was somewhat improved.

"This is the largest mine, excepting No. 4, in the Wellington colliery, but it will yet be the most extensive. The coal is brought to the bottom of the shaft by a steam engine from a slope, from the south and west by a self-acting incline, and on the east by mules, by what is known as the east level, but at present they are erecting a large engine to haul the coal out of this level on the endless rope system.

"In the slope the coal is very good, and is worked on the long-wall plan, for which it is well adapted, for here they have a face of coal about 1,000 yards long, and from four to seven feet thick. This is along one side. The opposite side is nearly all solid. All this is without a fault of the smallest kind.

"In the east level all the work has been, and is, on the pillar and stall principle, the coal varying in thickness from four to ten feet and hard. In this level there is also a great deal of work being done at the pillars (coal), and these pillars being nearly two-thirds of the whole seam, it takes longer to mine out the pillars than the stalls, although one man can put more coal a day out of the pillars.

"In the south and west sides all the mining is at the pillars, of which there is a great extent.

"Ventilation is very good. Motive power is a fan on the up-cast shaft driven by a large steam engine. When I was down in December I found 108,000 cubic feet of air passing per minute for the use of 202 men and twenty-six mules; fan making 100 revolutions per minute; water gauge one inch. This mine is ventilated by separate splits, the three main divisions being at the bottom of the shaft—to the east level 28,000 cubic feet per minute for the use of sixty-four men and eleven

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mules. There were 34,000 cubic feet going down the slope. This is again split into two currents, to be used by seventy-five men and two mules. To the west level, south incline and part of east side, 46,000 feet were in circulation for forty-four men and five mules. The above-mentioned currents of air never come in contact until they come to the bottom of the up-cast shaft. There is now very little gas seen in this mine, but occasionally it is found in the long-wall workings, where the roof breaks or falls out, leaving a hole. There is always a strong air blowing along the face. This mine is also free from dust.

"In addition to the overman and fireman, there is a staff of shot-lighters and examiners to each district of the mine. These men are always on the move from one place to another, and as shot firing is at stated times during the shift, the smallest change in any part of their particular district, or any fall from the roof in the airway, is sure to be found out and reported to the overman, if they cannot stay themselves to attend to it.

"This pit is connected with No. 6 pit, to which there is a good travelling way, with boards put up pointing the way.

"In addition to the steam engine and air compressors, Messrs. Dunsmuir & Sons are now erecting an electric plant, manufactured by Messrs. W. T. Godden & Co., London, England. It will be seen that electricity is getting to be quite generally used in and about the mines in this district; it being used for cutting coal, pumping, and, as the power in electric locomotives, to haul the coal in the mine.

No. 6 Pit, Wellington Colliery.—"This pit is mentioned in a previous report as being about 900 yards east of No. 4 pit, only being separated by a narrow strip of solid coal of forty yards thick. Just now this strip is serving the purpose for which it was left—in case of any fire in the mine and having to put water in to quench the fire. As the fire last September in No. 4 pit caused that mine to be filled with water so that strip of coal barrier has been the means of saving both this No. 6 and No. 5 mine from having to be flooded, and also from putting nearly 1,000 men out of work for a long time. As I have already said this pit is connected under ground with No. 5.

"In this pit, as in the other mines, there has been a great deal of idle time during the past year, owing to the flooding of the California market with coal from other countries.

"No. 6 pit is getting to be quite an extensive mine; the coal is being brought to the shaft from the south and east by a level and self-acting incline, and to the west side by a slope and incline. Most of the mining on the south and east side is on the long-wall system, while

that on the north and west side is pillar and stall, and at the pillars (coal) coal is very hard, from four to eight feet thick and of the usual good quality, and the roof is somewhat stronger than it is generally over the top of this coal. When the coal is down to five feet in thickness, long-wall is the favourite method of working, as the coal is got out in better condition and in larger pieces, and there is not so much waste.

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"Ventilation is good; the motive power is a fan on the Murphy principle, worked by a steam engine. The last time I was down in December there was a current of 72,500 cubic feet of air passing per minute, for use by 144 men and 26 mules. There are five separate divisions in the air, all of the divisions being near to the bottom of the shaft; three of them are on the east side and two of them on the west side of the shaft. Two of these splits are one to each division of long-wall work, and the other three are to the divisions of the pillar and stall workings; and when they are taking out pillar coal the air is well conducted into the long-wall, and also to the other places, by brattice or otherwise. In the long-wall the air goes in the level, and what escapes at the different roads is caught at the face, then passes along to the return. The motive power or fan is on the same shaft as the coal is hoisted from, there being a tight partition in the shaft, one side being the intake and the other upcast. Although this mine is connected with No. 5 pit, it is ventilated independently of No. 5, the connection only being in one place, where there are strong doors; at the same time there is a good travelling way by means of No. 5. No. 6 pit is free from dust.

No. 2 Slope, Wellington Colliery.—"There has not been anything done here during the past year.

Alexandra Mine.—"This mine belongs to Messrs. Dunsmuir & Sons, and is about one mile south of the Southfield mine, of the Nanaimo Colliery, and only a few yards from the Esquimalt and Nanaimo Railway. There has not been any work done here during the past year, but the company renewed operations at the beginning of the new year, and it is hoped there will be a good account of this mine at the close of 1893.

East Wellington Colliery.—"This colliery belongs to the East Wellington Coal Company. There are two shafts.

"*No. 1 Pit.*—There has been no mining done here since February. This pit is the return or up-cast shaft for No. 2 pit, which is about 800 yards further up the valley of the Millstone River.

No. 2 Pit, East Wellington.—"In this they have been working steadily all the year, but not full handed, owing to the slackness of trade at San Francisco, where all the coal from this colliery goes.

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"Previous to this year all the coal was mined from what is known as the Wellington seam, varying in thickness from four to seven and a half feet. In this they have been much troubled with faults in the coal of one kind and another, which made it expensive to get out. This causes the superintendent to use greater skill and economy in getting the article to the market. There is a large body of this coal in sight. In addition to this they have at one of the faults run a tunnel through the rock to an upper seam of coal, which is two feet thick and of very good quality—very hard. This is the principal place where they are taking coal at present. This coal is well sought after in the San Francisco market, and the company command the highest price for all that they can produce. We may also expect to see some of the other coal companies going into this once despised but now acknowledged to be valuable upper seam, which is about fifty feet above what is in this district called the Wellington coal.

"The workings are on the long-wall system, and the seam is well adapted for it.

"Ventilation is good. Motive power, a fan, driven by a steam engine at the top of No. 1 shaft. When I was last down in December, I found 22,000 cubic feet of air passing per minute for the use of forty-four men and four mules. The air is split at the bottom of No. 2 shaft—9,500 feet going to the west side, and 12,500 feet to the east side. In the long-wall the air travels along the face, there not being much chance for it to escape, except a little at the roadway, and so the workings are kept clear. It is the intention of Mr. Chandler, the manager, to connect the workings of this upper seam with the shaft, which is not many yards away, and when done it will be a great relief to the ventilation of this place, and also facilitate the getting out of the coal.

"There is now very little gas found in the mine, there not being much chance for it to collect in the old works, as they are filled in as close as possible, and the roof settling behind makes it almost solid again. And every other precaution is taken to prevent accidents of any kind. In addition to the manager and overman, there is the regular staff of firemen—one on each shaft, who also acts as shot-lighter. As there are not any old waste works to go into in long-wall, the fireman can see all the working places frequently during the day, as well as the overman.

Union Colliery, Comox.—"This colliery is the property of the Union Colliery Company. A first-class article of coal is produced at the mines of this colliery, which makes excellent coke. This coke has

taken the market in this province, and is also highly spoken of by those that now use it in San Francisco.

"Work in this company's mines was at a standstill for about six months of the past year. In two of the mines work has recently been resumed.

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No. 1 Shaft, Union Colliery.—"There has been nothing done here during the past year.

No. 1 Slope, Union Colliery.—"In this slope the miners worked most of the time from January to June, when it was stopped, and has not yet started. In many places the coal is very good. At the time of its stoppage this was the chief producing mine of this colliery.

"Ventilation, machinery, and everything is in its usual prime condition. There is a prospect of work being resumed here soon.

No. 4 Slope, Union Colliery.—"Excepting in the main slope, this mine was also at a stand for five months. In November, work was resumed; the coal market being somewhat improved, or as may be said, the cheap coal from other countries has slackened off. This mine is being pushed so that the company may have their fair share of what is being exported to California. This is now the producing mine of the colliery, and close upon 600 tons per day are put out. For steam purposes, those that have used it say that the coal is the best article produced upon the coast. H. M. S. warships have used a considerable quantity of the coal, and the Naval Officers report it as equal to any coal that they have got from Cardiff, in Wales. The seam varies in thickness from three to ten feet, with a gentle pitch, so that the mine cars can be taken around when required. The slope is now down 800 yards—the coal keeping good. Ventilation good. Motive power, a Guibal Fan; running slow, yet passes 50,000 cubic feet of air per minute. This mine is ventilated on the separate split method. The last time I was down, the above volume of air was passing per minute for the use of forty-four men and four mules.

"I may remark that there are five levels off the east side of the slope, while the west side is nearly all solid, very little of it being yet worked. Coal looking well, for a valuable and extensive mine.

"Everything about this mine is got up on the best plan for labour saving. There is a large coal washing machine by Shepherd, of Cardiff, Wales, of the most recent improvement in construction, capable of cleaning 350 tons per day; it is said to be able to save the finest coal, this fine coal being what they are now making into coke so successfully. The demand for the coke is large and active.

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No. 1 and No. 2 Tunnels, Union Colliery.—"These tunnels or adit levels were also at a stand for about six months, and were almost closed up at the entrances by board fences, so that no persons could reach the levels and get into any danger.

"This mine has again started to work—in December. The coal is from two to three feet thick, of good quality, and very hard.

"When I was in this mine, in December, the ventilation was good. Gas has been found in this mine, but there is no gas at present noticeable.

"The workings are long-wall; the air going in the level, and coming out from under a height where the coal is worked out to daylight. An air furnace is used here.

Prospecting.—"A series of boreholes has been put down in this coal field during the past year, and these bores show indications of great productiveness of coal.

"It is the intention of the company to build a number of coke ovens, so that the fine coal not used in the furnaces of the colliery may be turned into coke.

Tumbo Island Coal Mining Company.—"This Company having made considerable exploring and boring on this Island, are continuing to energetically prospect their seam.

"In the borehole put down on the south side of the Island, at about 320 feet, coal was struck, of a thickness to justify them in sinking a shaft. This they started on 21st January, 1892: size ten by twelve feet, having sandstone and conglomerate rock for the first eighty-five feet, when dark shale was struck of six feet thick; then they got a good seam of coal six inches thick, and underneath was six more feet of dark shale, then sandstone was met with containing pieces of coal, and they have now got down 114 feet; timbered from top to bottom, and very little water to contend with. In addition to the ordinary hoisting machinery there is a ladder from the top to the bottom of the shaft.

"I am indebted to the Manager for information as to this mine, and hope that the company will continue to be successful in their development of their valuable property until they have opened a seam of good coal of commercial value. The mine is in the way of steamboats going between Victoria and the Mainland, and the China steamers go close by.

The Kamloops Coal Company Limited.—"The colliery of this Company is known as the North Thompson Coal Mines.

"The mine is as yet little more than a prospect, but it is very promising. From the report of the Company received by me, I gather that

the work consists of a level driven on the strike about N. 10° E. 45 feet, and slope on the dip about E. 10° S. 55 feet: this slope to be opened towards the surface. The seam opened is the top of a series of four, and at present face shows about thirty-seven inches of coal, which assays very favourably, and the seam is said to be thickening gradually. The lower seams have not yet been opened, but are reported to be considerably thicker than the one being worked, as indicated by the croppings.

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In the summary report of the Geological Survey Department for 1892 Mr. James McEvoy writes as follows of two points visited by him in the southern interior of British Columbia:—

“ While in the neighbourhood an opportunity was afforded of visiting the coal mine on the North Thompson Indian Reserve. A tunnel running northward from the creek bed showed the following section:—

Coal.....	6 inches.
Sandstone.....	2 feet (variable.)
Coal.....	9 inches.
Sandstone.....	6 “
Coal.....	18 “

“ Besides these an underlying seam of coal is reported.”

* * * * *

“ A visit was paid to the Coal Hill mine, three miles south of Kamloops. An incline was being sunk along the dip of the seams, and in it the following section was seen:—

Coal.....	3 inches.
Shale.....	5 “
Coal.....	12 “
Clay.....	4 “
Coal.....	2 “
Shale.....	6 “
Coal.....	3 “
Shale and clay.....	5 “
Coal.....	5 “
Shale and sandstone.....	12 “
Coal.....	2½ “
Sandstone.....	8 “
Coal.....	3 “

“ The quantity of clay is variable and some of the shale partings are not continuous.”

COKE.

Coke.

There was a slight falling off in 1892 in the production of coke, the quantity produced being 56,135 tons valued at \$160,249, while in 1891 the production was 57,084 tons. The production is altogether that of Nova Scotia where it is principally used in the manufacture of pig-iron at Londonderry. No returns have been received from British Columbia.

The production of coke during the past seven years is as follows :—

1886.....	35,396 tons, valued at \$101,940
1887.....	40,428 " 135,951
1888.....	45,373 " 134,181
1889.....	54,539 " 155,043
1890.....	56,450 " 166,298
1891.....	57,084 " 175,592
1892.....	56,135 " 160,249

The following table 1 gives the quantity and value of oven coke imported during the fiscal years from 1880. The quantity of gas coke imported during the year was 589 tons valued at \$1,755. This would represent a home consumption of coke of all kinds of 56,724 tons, not including the large quantities annually sold by the various gas companies throughout the Dominion.

Imports of
coke.

COKE.

TABLE 1.

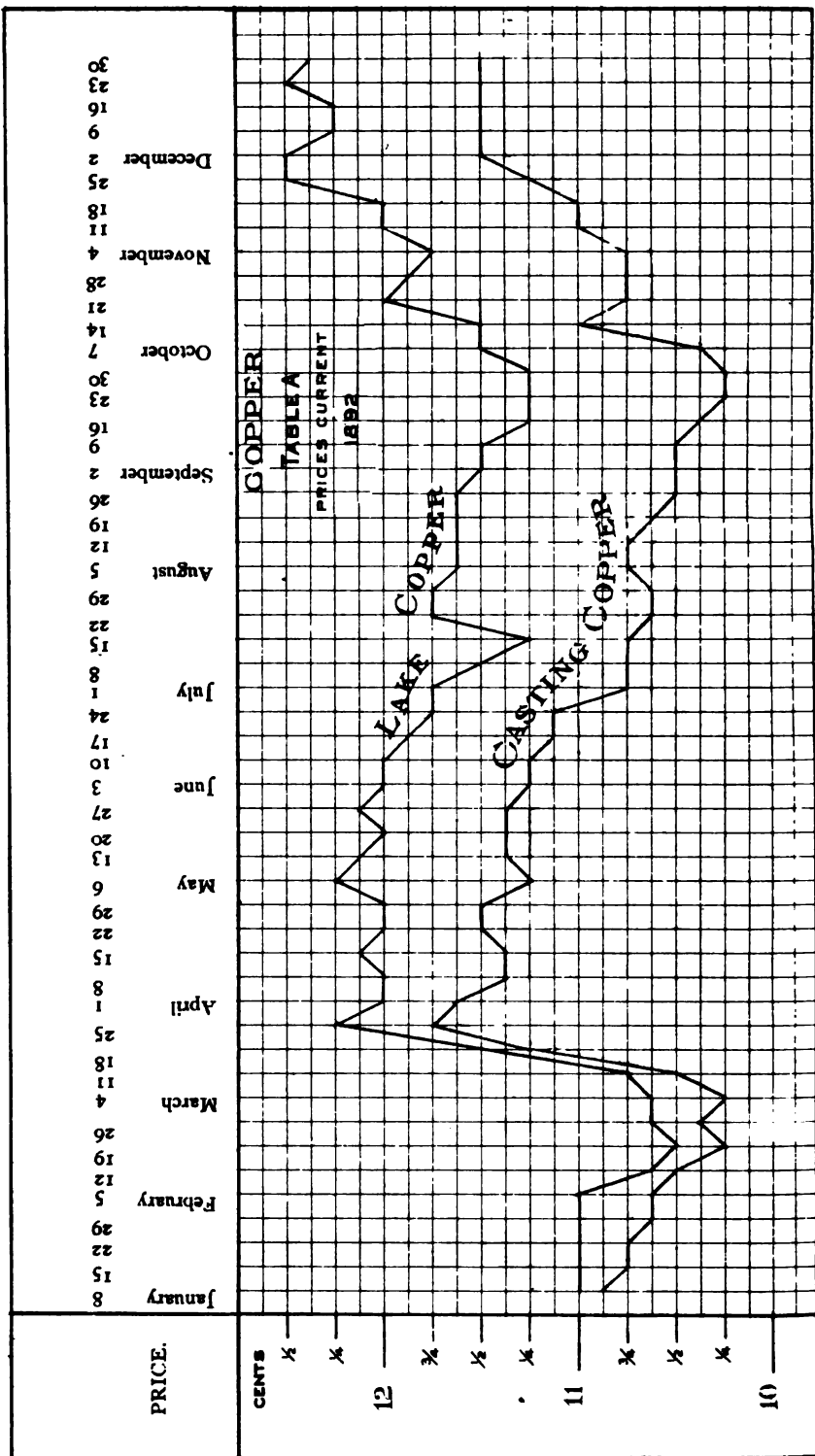
IMPORTS OF OVEN COKE.

Fiscal Year.	Tons.	Value.
1880.....	3,837	\$ 19,353
1881.....	5,492	26,123
1882.....	8,157	36,670
1883.....	8,943	38,588
1884.....	11,207	44,518
1885.....	11,564	41,391
1886.....	11,858	39,756
1887.....	15,110	56,222
1888.....	25,487	102,334
1889.....	29,557	91,902
1890.....	36,564	133,344
1891.....	38,533	177,605
1892.....	43,499	194,429

GEOLOGICAL SURVEY DEPARTMENT OF CANADA

ALFRED R. C. SELWYN, C. M. G., LL. D., F. R. S., DIRECTOR.

PLATE V.



COPPER.

COPPER.

STATISTICS.

Statistics.

The amount of copper produced during 1892 was 7,087,275 pounds, whose whole value at the average market price for the year, viz., 11½ cents, would come to \$826,849. For 1891 the figures were 8,929,921 pounds valued at \$1,160,760, so that there is a falling off of 1,842,646 pounds and \$333,911.

This falling off is mostly due to the much smaller shipments of copper-nickle matte, etc., from Sudbury, the shipments of cupriferous pyrite from the eastern townships of Quebec, showing a falling off also but to a less extent. The lessened value of Canada's production of copper for the year is further aggravated by the fall in the average price of the metal from 13 cents per pound for 1891 to 11½ as given above for 1892.

The above given figures represent as in past years the total number of pounds of copper contained in the ores and matte shipped from the mines in the vicinity of Sherbrooke in Quebec, and Sudbury in Ontario. The spot value of these ores will, of course, fall very far below the values realized by the operators who sell their products in very varying conditions of concentration. Taking this into account the spot values of the copper in the ore, matte, etc., as compared with their full value would not come to more than about 50 per cent of the figures above given.

DISCOVERY AND DEVELOPMENT.

Discovery and development in Nova Scotia.

NOVA SCOTIA.

Regarding operations in the provinces of Nova Scotia and New Brunswick, Mr. H. P. Brumell, reports as follows :—

The Eastern Development Company.—"This company has done a considerable amount of exploratory and underground work on their properties, consisting of two large areas and comprising the Argyle and Coxheath grants covering in all 1,280 acres. These are adjoining, and are situated on the north side of the Coxheath Hills and opposite the French Vale, a distance of about ten miles south west of Sydney, Cape Breton county.

"At the time of my visit the mines were idle and the workings full of water. Evidence of a large amount of both underground and surface work was, however, plainly visible, the dumps containing about 3,000 tons of ore, some of which had been hand picked and a large proportion crushed and jigged; no shipments have been made excepting a few tons for test purposes. The buildings and plant in connection with the mine are extensive and well adapted for the work.

COPPER.

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development
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tion with the mine are of first class quality and in excellent condition and consist of :—

“ Buildings.—At working shaft No. 2 : Shaft-house, dry-house, boiler, engine and compressor-houses, ore dressing, crushing and screening shed, machine shops, saw-mill, carpenter and blacksmith shops, magazine and office and laboratory.

“ At shaft No. 1.—Shaft-house, store-house, boiler-house, dry-house and stables, and some distance to the north manager's house, stable, boarding-house, foreman's house and mine's store.

“ Plant.—One fifteen-horse power boiler ; one Knowles sinking pump ; one hoisting engine, forty-inch drum ; three fifty-horse power, and three twenty-horse power economiser boilers ; two Rand double compressors ten by sixteen-inch cylinders ; twelve Rand slugger drills complete ; two single acting pumps, seven-inch stroke, three-inch suction ; one Blake fire pump ; one hand pump ; one Blake crusher (ten by seven), screens, etc. ; one saw-mill, engine and saws complete ; screw-cutting lathe complete ; piping, tools, screens, cars, etc.

“ It is the intention of the company at no very distant date to erect large smelting works near the mouth of Watson's creek on the north-west arm of Sydney harbour, about six miles from the mines, with which there will be a tram connection. The intention is to erect a battery of eight reverberatory furnaces of about twenty tons capacity each, in all 150 tons per day. If it be found necessary they will erect calcining furnaces.

“ Traversing the country in a north-easterly direction and constituting the greater mass of the Coxheath hills is a large body of felsitic rocks very much broken and fissured, carrying large and small masses and veins of copper and iron pyrites containing small quantities of gold and silver and, it is said, entirely free from antimony, arsenic or any other refractory materials. A small quantity only of quartz and calcite is noticeable in the ore in the dumps. The belt of cupriferous felsite is about 1,500 feet wide following the general trend of the hills, about north-east and south-west. Six distinct veins from two to twenty feet wide are said to have been located and exploited, work having been carried on to a depth of 176 feet in No. 1 shaft and 320 feet in No. 2, and a considerable extent of ground opened up by means of cross-cuts, levels, winzes, etc.

"The following analyses of the ore are available :

I. By C. Tennant Lee, Boston.

II. By Maletta Works, Rouen, France.

III. By F. Claudet, London, England.

IV. By H. O. Hofman, Inst. Technology, Boston.

V. do do (Surface ore from new vein.)

COPPER.

Discovery and
development
in Nova
Scotia.

—	I.	II.	III.	IV.	V.
Copper.....	12·97	11·5	8·99	7·95	6·79
Iron.....	14·47	14·1	12·83	14·93	15·79
Sulphur.....	17·26	18·5	13·40	8·98	8·10
Siliceous rock.....	53·14	54·9	61·63	48·48	47·47
Arsenic.....	None.	·011	·05	·09	·012
Antimony.....	do	None.	Traces.	None.	None.
Cobalt.....			·06		
Lime.....	2·14		1·05	Trace.	Trace.
Magnesia.....			·32	3·45	3·88
Alumina.....			·94	7·94	8·02
Oxygen and loss.....			·73		
Silver.....	Traces.	Traces.	oz. dts. grs. 0· 5· 0	Oz. 1·5	Oz. 1·3
Gold.....	Trace.		0· 10· 0	Trace.	Trace.

NEW BRUNSWICK.

New Bruns-
wick.

Albert County.—"At Alma the New Brunswick Mineral Developing Company have leased the old McKinley lot, block 10, lot 6, parish of Alma, about two miles north of Herring Cove, and have carried on active prospecting work in search of a body of chalcocite (copper glance) supposed to exist in the neighbourhood. The operations have so far proved unsuccessful; small veins and stringers of chalcocite only having been noted, as well as several large veins and masses of quartz stained with and carrying small proportions of chalcocite and copper carbonates. Large masses of "float" chalcocite have been found at many points in the neighbourhood, and it had been hoped the exploratory work undertaken here would result in the discovery of large workable deposits. The field of operations is near the junction of the lower Carboniferous rocks with the pre-Cambrian and the rocks as exposed by trenching, etc., have proven to be dioritic and pre-Cambrian in age, the whole being cut up by a reticulation of large and small quartz veins carrying, as far as seen, small quantities of chalcocite and copper carbonates.

Vernon Mine.—"This old property situated in St. Martin's parish St. John county, on the shores of the Bay of Fundy and about eight miles west of Herring Cove, has, it is said, been taken up by Messrs.

COPPER. Van Meter of Moncton and Gue of Halifax, who have cleaned out the old workings and intend prospecting and developing.
 Discovery and development in New Brunswick.

Quiddy River.—"Mr. J. F. Fraser of St. John, has taken out a lease covering the old copper property at the mouth of the Quiddy river near Martin's Head, parish of St. Martin's, St John county, and intends having the property opened up and thoroughly prospected."

Quebec. **QUEBEC.**

The Nichols Company continued to operate their mines, acid and superphosphate works at Capelton near Sherbrooke. Of the sulphuretted ores extracted from their mines the larger proportion was shipped raw to the chemical works of the company at Laurel Hill in New Jersey. The remainder was burnt at the Capelton works to supply the necessary sulphurous gases for the manufacture of sulphuric acid, whilst the residue from the process was treated in a small water jacket furnace and shipped as matte.

At the Eustis mines near Capelton, ore was mined and all shipped in the raw state to the United States.

The Moulton Hill and Howard Mines Company were engaged mostly in developing their mines.

The value of the ores produced in this district lies chiefly in their sulphur contents, of which element they carry from 25 to 30 per cent. Besides the above they carry some three to four per cent of copper and a few ounces of silver per ton.

Some further development work was done at the Harvey Hill mines near Broughton on the Quebec Central Railroad.

The report of the Department of Crown Lands for Quebec draws attention to a discovery of some interest in the River Matane district, Rimouski county. This consists of the occurrence over a large area of numerous boulders of trappean rock, often weighing over a ton, in which are found numerous particles of native copper, weighing in some cases as much as a pound or a pound and a half. The main value of these boulders lies, of course, in their pointing to the occurrence of native copper bearing rocks in the vicinity, which might be located by further search and possibly at places be found to carry the metal in paying quantities.

Ontario. **ONTARIO.**

In this province the only copper ore mined was the chalcopyrite occurring in connection with the nickeliferous pyrrhotite deposits of Sudbury.

The chief contributors to the output of this district as formerly were the Canadian Copper Company, the Dominion Copper Company and Messrs. H. H. Vivian and Co. The mode of operating these

mines has been fully described in previous reports and need not, therefore, be repeated here.

COPPER.
Discovery and
development
in Ontario.

The shipments from this district consist altogether of matte containing about twenty-seven to twenty-eight per cent of copper.

Beside the above mentioned operators the Emmons Metal Company carried on development work at the Gersdorffite mine and a little prospecting work was done by a few others.

The industry in Quebec and Ontario employed about 1,100 men exclusive of those engaged in actual prospecting.

An interesting feature in Ontario is to be found in the work which has been prosecuted for the past two years at Cape Mamainse on Lake Superior on the copper bearing veins and beds of the Keewenawan series. Small areas of these rocks occur at several places along the north shore of Lake Superior, forming the edge of the formation which is found in its largest development at Keewena Point on the south shore, where the Calumet and Hecla and other famous copper mines are located.

These rocks constitute the shore at Cape Mamainse extending back probably from five to seven miles from the extremity of the point. Here several mineral properties were taken up some fifty years ago, chief amongst which are the Pan-cake Bay and Sand Bay locations with the adjoining one of the Lake Superior Native Copper Company, which latter was worked extensively from 1880 to 1884, since when nothing has been done there.

The work at present in progress is confined to the two first mentioned properties, which cover an area of from fifteen to twenty square miles. This work was carried on during the entire year with a force of about twelve men with steam hoisting plant and pump and compressed air drills. A Sullivan diamond drill was used in testing the property supplementing the information gained through the test shafts and openings made on the outcroppings of the veins, etc.

The local character of the formation is that of a number of trappean beds, often amygdaloidal, interbedded with coarse boulder conglomerates. The strike of the formation is north-west, dipping at 25° to 30° westerly or lakewards.

Native copper is found scattered all through the volcanic rocks in shot and leaf form, etc., whilst the small fissures are apt to carry plates, leaves, etc., of the metal. A number of larger and more persistent fissure veins have also been located carrying shot, leaf and mass copper and also rich sulphuretted ores of the chalcocite type. These seem generally to hold a considerable proportion of silver, some assays

COPPER. showing 25 to 30 oz. of that metal and run high in copper contents (69 per cent and thereabouts).
Discovery and development in Ontario.

Both the fissure veins and bedded deposits have received attention in past years and of late. The reports of the results of these later efforts would seem to have yielded very favourable and hopeful returns and indeed it would seem strange if with such widespread indications of copper no workable deposits were to be found.

British Columbia.

BRITISH COLUMBIA.

Prospecting and development was fairly active in the districts of East and West Kootenay on deposits carrying copper sulphurets in conjunction with argentiferous galena. Although these are worked more particularly with a view to the silver, which is carried both by the galena and the copper sulphurets, yet when they come to be worked on a large scale much copper will necessarily be produced in the district.

During the visit of Mr. E. D. Ingall to the province to study its mining districts, some copper claims were visited in the Illecillewaet district at which he made the following notes :—

“Proceeding from Illecillewaet station on the Canadian Pacific Railway a trail of about ten miles through the mountains brings one to Copper Mountain. Here some veins have been located, carrying copper ores in the shape of the yellow sulphuret or chalcopyrite and bornite. The owners of the claims are Messrs. Ryckman, M.P., of Hamilton, Ont., and Scott, of Illecillewaet. The former has had assays of the ores made which were said to run 61 per cent copper, \$20 in gold and \$8 in silver.

“The chief vein on the Silver Bow claim shows in the face of a lofty cliff of talcose and chloritic schistose rocks on whose face it is visible for a distance of 300 to 400 feet, the cliff forming one face of a sharp V shaped spur of the mountain. It dips westerly at an angle of about 45° thus cutting the spur in such a way as to pass both above and below over on to its other face.

“The vein is from one to three feet wide and carries the ores in irregular masses and ribs in a gangue, sometimes dolomitic and rusty weathering from the presence of much iron and sometimes consisting of white opaque or translucent quartz. Amongst the ore extracted were seen many lumps of several pounds weight of almost solid sulphuret and in many cases the attached quartz was found to be crystallized and interpenetrating or leaving the imprint of its pyramidal terminations in the ore.

“The country rocks at the place examined were a pale talcose schist above the vein and a darker green, probably chloritic, schist below it.

This relationship would not, however, be found to persist as the vein is seen to cut across the rocks lower down the mountain side. At this place the rocks strike about N. 60° W. and dip E. < 55°.

Discovery and
development
in British
Columbia.

"The rocks constitute part of a belt running in a southerly direction crossing the Canadian Pacific Railway some distance east of Illecillewaet station.

"At places they show numerous small veinlets, carrying hematite in quartz gangue and showing stains of malachite, probably due to the weathering of a certain amount of disseminated copper sulphurets which are to be found at places. These are flanked on the west by the black shale series which enclose most of the galena veins proper of the district.

"Several other claims visited in Illecillewaet district showed sulphurets of copper occurring in conjunction with galena."

EXPORTS AND IMPORTS.

Exports and
imports.

The accompanying tables Nos. 1, 2 and 3 give the figures of exports and imports of this metal and its ores, etc. :

The details of the exports are as follows :—

Copper Ore.

From Quebec 46 tons, valued at \$3,750
" Nova Scotia 24 " " 100

Copper Matte, etc.

From Ontario, 1,040,000 lbs., valued at \$79,141 to the United States.
" Quebec 45,022 " " 2,701 " "
" " 336,000 " " 17,430 " Great Britain.
" " 12,000 " " 600 " Germany.

Fine Copper.

From Quebec, 3,476,519 lbs., valued at \$173,910 to the United States.

COPPER.

TABLE 1.

EXPORTS.

Year.	Nova Scotia.	Ontario.	Quebec.	Total.
1885.			\$262,600	\$262,600
1886.		\$16,404	232,855	249,259
1887.		3,416	134,550	137,966
1888.			257,260	257,260
1889.			168,457	168,457
1890.		2,219	396,278	398,497
1891.		64,719	283,385	348,104
1892.	\$100	79,141	198,391	277,632

COPPER.
Exports and
Imports.

COPPER.

TABLE 2.

IMPORTS : PIGS, OLD AND SCRAP.

Fiscal Year.	Pounds.	Value.
1880..	31,900	\$ 2,130
1881.....	9,800	1,157
1882.....	20,200	1,984
1883.....	124,500	20,273
1884.....	40,200	3,180
1885.....	28,600	2,016
1886.....	82,000	6,969
1887.....	40,100	2,507
1888.....	32,300	2,322
1889.....	32,300	3,288
1890.....	112,200	11,521
1891.....	107,800	10,452
1892.....	343,600	14,894

COPPER.

TABLE 3.

IMPORTS : MANUFACTURES.

Fiscal Year.	Value.
1880.....	\$123,061
1881.....	159,163
1882.....	220,235
1883.....	247,141
1884.....	134,534
1885.....	181,469
1886.....	219,420
1887.....	325,365
1888.....	303,459
1889.....	402,216
1890.....	472,668
1891.....	563,522
1892.....	422,870

GRAPHITE.

GRAPHITE.

The production of this mineral for 1892 was less than for the previous year as shown below :

1891.....	260 tons,	valued at \$1,560
1892	167 " "	3,763

The above amounts resulted, as in former years, from working the graphitic deposits in the Laurentian rocks of Quebec.

DISCOVERY AND DEVELOPMENT.

GRAPHITE.
Discovery and
development
in New
Brunswick.

NEW BRUNSWICK.

During his visit to the province Mr. H. P. Brumell learned the following facts regarding graphite mining in the province :—

“Split Rock, St. John, N.B.—At the Best mine, St. John, a small force of men were employed until the fall, when operations ceased owing to the prevailing low price of graphite in the United States where most of the ore was marketed. While shipments were being made the ore was milled at the mine and a finer quality than usual shipped.

“It is to be regretted that this property which had lately been so thoroughly equipped and showed such excellent material should be idle, but it is confidently expected that during the coming season operations will again be undertaken. The property is owned and operated by Messrs. W. F. Best *et al.*, of St. John, N.B.”

QUEBEC.

Quebec.

In this province some little work was done on some of the deposits of the mineral which occur in the Laurentian rocks of the county of Ottawa which have been described in previous reports of the division.

Claxton Mine.—Mr. John Claxton of Inverary, Ont., had a force of five men at work on lots 12 and 14, range X., of Buckingham township. He made a trial shipment to England of mineral containing about 20 per cent of graphite at a cost of transport from Buckingham to Liverpool of \$4.50 per ton. According to Dr. Ells, who visited the place, the graphite, the quantity of which is quite extensive, is disseminated through a gray rusty gneiss.

Weart Mine.—This property with the plant erected there was described in the report for last year. The workings are situated on lot 26 in range VI., Buckingham. Several hundred tons of ore were mined, and a small quantity was treated in the mill, the result being shipped. The force employed consisted of twenty men. The cost of shipment to the Canadian Pacific Railway at Buckingham is given as \$3 per ton.

Walker's Mine—This property was not in operation during 1892, other than to complete the enlargement and improvements on the mill.

Bowie's Mine.—Some development work was done by Captain Bowie of Ottawa, on lot 47, range, XIV., Hinks township.

Lewis Mine.—Dr. Ells reports that a deposit is being opened up at the south-east end of Donaldson's Lake by Mr. Lewis, where the graphite occurs in veins up to the two inches thick in hard felspathic rock.

GRAPHITE.

Exports and imports.

EXPORTS AND IMPORTS.

Tables 1, 2 and 3 following give the data obtainable regarding exports and imports, and are self-explanatory :

GRAPHITE.

TABLE 1.

EXPORTS.

Year.	New Brunswick.		Ontario.		Quebec.	
	Cwt.	Value.	Cwt.	Value.	Cwt.	Value.
1886.....	8,142	\$3,586				
1887.....	6,294	3,017				
1888.....	2,700	1,080				
1889.....	660	422	22	\$116		
1890.....	400	160	329	1,369		
1891.....	464	72				
1892.....	1,224	449	15	60	4,590	\$3,443

GRAPHITE.

TABLE 2.

IMPORTS OF RAW AND MANUFACTURED PLUMBAGO.

Fiscal Year.	Plumbago.	Manufactures of Plumbago.
1880.....	\$1,677	\$2,738
1881.....	2,479	1,202
1882.....	1,028	2,181
1883.....	3,147	2,141
1884.....	2,891	2,152
1885.....	3,729	2,805
1886.....	5,522	1,408
1887.....	4,020	2,830
1888.....	3,802	22,604
1889.....	3,546	21,789
1890.....	3,441	26,605
1891.....	7,217	26,201
1892.....	2,988	23,086

GRAPHITE.

TABLE 3.

IMPORTS OF BLACK-LEAD.

Fiscal Year.	Value.
1880	\$18,055
1881	26,544
1882	25,132
1883	21,151
1884	24,002
1885	24,487
1886	23,211
1887	25,766
1888	7,824
1889	11,852
1890	10,276
1891	8,292
1892	13,560

GRAPHITE.

Exports and Imports.

GYPSUM.

PRODUCTION.

GYPSUM.

Production.

The quantity of gypsum mined and marketed during 1892 was 241,048 tons valued at \$241,127 which shows a marked increase over that of the previous year, the gain being 37,443 tons and in value \$34,876. The following table illustrates the production by provinces.

GYPSUM.

TABLE 1.

PRODUCTION BY PROVINCES.

Province.	Tons.	Value.
Ontario	4,320	\$ 5,399
Nova Scotia	197,019	170,021
New Brunswick	39,709	65,707
Totals.	241,048	\$241,127

GYPSUM. Practically the whole of the production of Nova Scotia and New Brunswick was exported, the greater part going to the United States, whereas the production of the Ontario mines was used locally.

The amount of rock ground and sold in Canada as land plaster was 3,523 tons valued at \$13,743, while of Plaster of Paris there were 11,387 tons sold valued at \$51,244, a large increase in quantity over the previous year though in point of value the production showed a decrease of \$3,795. There was also a considerable quantity of "Alabastine" and "Adamant" manufactured by the Alabastine Co. of Paris and the Adamant Manufacturing Co. of Toronto respectively.

The production during past years was as follows :—

1886.....	162,000 tons, valued at \$178,742
1887.....	154,008 " 157,277
1888.....	175,887 " 179,393
1889.....	213,273 " 205,108
1890.....	226,509 " 194,033
1891.....	203,605 " 206,251
1892.....	241,048 " 241,127

There are no new developments to report, the industry being carried on in the same districts and very much in the same quarries and mines as in previous years. Regarding operations in the vicinity of Minas Basin, N.S., Mr. H. P. Brumell reports as follows :—

Minas Basin, N.S. "During the year a visit was made to the quarry operated by the Wentworth Gypsum Quarrying Co., at Wentworth, near Windsor, where quarrying is done on a large scale and large quantities of gypsum annually produced. The rock quarried here is all exported, most of it going to the United States, where on account of its purity, it is in great demand. All the gypsum occurrences of the district are very similar in character and the quality of the rock invariably good.

"The mode of occurrence and extent of gypsiferous territory has been so often referred to that comment here is unnecessary.

"During the year many of the larger gypsum quarries of both Nova Scotia and New Brunswick were visited, the operators in all cases reporting the industry to be in a good condition."

EXPORTS AND IMPORTS.

GYPSUM.

The following tables of exports and imports explain themselves :— Exports and imports.

GYPSUM.

TABLE 2.

EXPORTS OF CRUDE GYPSUM,

Years	ONTARIO.		NOVA SCOTIA.		NEW BRUNSWICK.		TOTAL.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
1874	.....	.....	67,830	\$ 68,164	.....	.....	67,830	\$ 68,164
1875	.....	.....	86,065	86,193	5,420	\$ 5,420	91,485	\$ 91,613
1876	120	\$ 180	87,720	87,590	4,925	6,616	92,765	94,386
1877	.....	.....	106,950	93,867	5,030	5,030	111,980	98,897
1878	489	675	88,631	76,695	16,335	16,435	105,455	93,805
1879	579	720	95,623	71,353	8,791	8,791	104,993	80,864
1880	875	1,240	125,685	111,833	10,375	10,987	136,935	124,060
1881	657	1,040	110,303	100,284	10,310	15,025	121,270	116,349
1882	1,249	1,946	133,426	121,070	15,597	24,581	150,272	147,597
1883	462	837	145,448	132,834	20,242	36,557	166,152	169,228
1884	688	1,254	107,653	100,446	21,800	32, 51	130,141	134,451
1885	525	787	81,887	77,898	15,140	27,730	97,552	106,415
1886	350	538	118,985	114,116	23,498	40,559	142,833	155,213
1887	225	337	112,557	106,910	19,942	39,295	132,724	146,542
1888	670	910	124,818	120,429	20	50	125,508	121,389
1889	483	692	146,204	142,850	31,495	50,862	178,182	194,404
1890	205	256	145,452	139,707	30,034	52,291	175,691	192,254
1891	5	7	143,770	140,438	27,536	41,350	171,311	181,795
1892	.....	.....	162,372	157,463	27,488	43,623	189,860	201,086

In addition to the above there was an exportation of ground gypsum to the value of \$20,255 of which \$17,977 was from New Brunswick and \$2,278 from Nova Scotia.

GYPSUM.

TABLE 3.

IMPORTS OF CRUDE GYPSUM.

Fiscal Year.	Tons.	Value.
1880	1,854	\$3,203
1881	1,731	3,442
1882	2,132	3,761
1883	1,384	3,001
1884	.....	3,416
1885	1,353	2,354
1886	1,670	2,429
1887	1,557	2,492
1888	1,236	2,193
1889	1,360	2,472
1890	1,050	1,928
1891	376	640
1892	626	1,182

GYPSUM.
Exports and
imports.

GYPSUM.
TABLE 4.
IMPORTS OF GROUND GYPSUM.

Fiscal Year.	Pounds.	Value.
1880	1,606,578	\$ 5,948
1881	1,514,714	4,676
1882	759,460	2,576
1883	1,017,905	2,579
1884	687,432	1,936
1885	461,400	1,177
1886	224,119	675
1887	13,266	73
1888	106,068	558
1889	74,390	372
1890	434,400	2,136
1891	36,500	215
1892	310,250	2,149

GYPSUM.
TABLE 5.
IMPORTS OF PLASTER OF PARIS.

Fiscal Year.	Pounds.	Value.
1880	667,676	\$ 2,376
1881	574,006	2,864
1882	751,147	4,184
1883	1,448,650	7,867
1884	782,920	5,226
1885	689,521	4,809
1886	820,273	5,463
1887	594,146	4,342
1888	942,338	6,662
1889	1,173,996	8,513
1890	693,435	6,004
1891	1,035,605	8,412
1892	1,166,200	5,595

IRON.

IRON.

Production.

PRODUCTION.

The below given figures show the production of iron ore for the Dominion by provinces :—

Nova Scotia.....	78,258 tons valued at \$194,581
Quebec.....	22,690 " " 62,385
British Columbia....	2,300 " " 6,900
	103,248 \$263,866

These figures show a very noticeable increase over those for 1891 of IRON. about 50 per cent in the totals of both quantity and value. The re. Production. turns give also an increased value per ton for the ores of Quebec and Nova Scotia. Ontario contributed nothing to the production last year.

Graphic table A and table No. 1 give the figures for 1892 in comparison with previous years :—

IRON.
TABLE 1.
NOVA SCOTIA : ANNUAL PRODUCTION OF ORE.

	Tons.
1876	15,274
1877	16,879
1878	36,600
1879	29,889
1880	51,193
1881	39,843
1882	42,135
1883	52,410
1884	54,885
1885	48,129
1886	44,338
1887	43,532
1888	42,611
1889	54,161
1890	49,206
1891	53,649
1892	78,258

EXPORTS AND IMPORTS.

The figures of the below given table No. 2, show a considerable increase in the exports of ore :—

Exports and imports.

IRON.
TABLE 2.
EXPORTS OF ORE.

Province.	1889.		1890.		1891.		1892.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
Ontario	4,108	\$10,407	18,601	\$38,967	2,259	\$ 3,932	*10,938	\$39,954
Quebec		2,700	120	1,640	191	2,683	203	2,324
Nova Scotia		100						
British Columbia	13,335	26,680	33	83	359	4,958	1,986	10,802
Totals		\$39,887	18,754	\$40,690	2,809	\$11,573	13,127	\$52,720

* Probably the product of the Province of Quebec, shipped via Ontario.

As in past years there are no imports to report.

IRON.

Discovery and
development,
Nova Scotia.

DISCOVERY AND DEVELOPMENT.

NOVA SCOTIA.

The iron mines of Pictou county were visited by Mr. H. P. Brumell, who supplies the following notes of the information he gleaned from the operators and from his own observations :—

“ On the East Branch of East River, Pictou county, extensive operations were carried on both in the development of iron deposits there and in the construction of the necessary works for the production of both common and charcoal pig-iron. Of the geology, character and mode of occurrence of the ore, Dr. E. Gilpin, jr., Commissioner of Mines, Nova Scotia, writes as follows :—*

“ ‘The ores next to be noticed are the limonites of the East River valley. From Springville to Sunny Brae the Lower Carboniferous marine limestones rest on the Upper Silurian and lower strata, the points of junction presenting at several places interesting sections of the deposition of the limestone on the clay-slates and other pre-Carboniferous rocks. The line of junction is at many points occupied by deposits of limonite, varying in thickness from three to twenty feet. At some points the ore-bearing ground appears from surface indications to be several hundred yards broad. At several openings the ores are highly manganiferous and specimens of pyrolusite of good quality have been found. The limestones connected with these ores at Springville and Black Rock are, in some instances, rich enough in carbonate of iron to be available for furnace use.”

“ ‘The source of these bodies of ore may be sought for in the oxidation and concentration of the iron in the limestones, and from the beds of red hematite in the Upper Silurian already referred to, several of which are in the immediate vicinity.”

* Trans. Am. Inst. M.E., Vol. XIV, 1885, p. 60.

“The ores are compact mammillated and fibrous, and their quality Iron. is shown by the following analyses:”

Discovery and development, Nova Scotia.

Composition.	I.	II.	III.	IV.
Iron oxides.....	88.92	93.00	81.19	48.223
Manganese oxide.....	.78	1.10	.20	14.410
Alumina.....	.71			
Lime carbonate.....	1.44			.015
Magnesia “.....	.82			Traces.
Phosphoric acid.....	.34		.15	
Phosphorus.....		None.		.020
Sulphur.....	.24	.04	Traces.	.480
Titanic acid.....	Trace.			
Silica.....	2.14	4.80	4.26	25.130
Moisture.....	4.61		13.60	12.530
Metallic iron.....	62.24	65.20	56.83	33.826

I.—Dr. S. Macadam.

II.—Dr. T. E. Thorpe.

III.—J. H. Huxley.

IV.—E. Gilpin, Jr.

“Active operations were being carried on by the Pictou Charcoal Iron Co., and the New Glasgow Iron, Coal and Railway Co., with furnaces at Bridgeville and Ferrona respectively.”

Pictou Charcoal Iron Co.—“This company owns a large area of land in the vicinity of and east of Bridgeville and apart from the land taken up for iron have several thousand acres of hardwood timber lands scattered over which they have many bee-hive charcoal kilns, three of which are situated at the works. Pictou Charcoal Iron Co.

“The mining development made by the company up to the time of my visit consisted of two drifts and several open cuts and pits. In No. 1 drift to the north of the furnace they drove into the face of the hill for a distance of thirty feet where they struck a nine foot vein of good ore, between red and yellow clay walls. The vein strikes N. 20° E and dips 46° S.W., and they had begun to rise on the vein to the surface a distance of ninety feet. Near the mouth of the drift and beneath

IRON. the surface soil and loam was found a shaly rock striking N. 30° E, dipping 15° S.E., between which and the ore the working was driven through about 100 feet of yellow clay, forming the hanging wall of the vein. In No. 2 drift, about 200 yards to the south-east, they had driven 260 feet and opened up a large body of very solid botryoidal limonite occurring under similar conditions to that in drift No. 1. Owing to the timbering, I was unable to get the course of the vein which is said to be a continuation of that opened in No. 1 drift, but which must describe a semi-circle to have been met with at this point. Immediately over No. 2 drift a large open cut has been made on the exposure of the vein on the crest of the hill and prior to 1892 some 4,000 tons of ore extracted and shipped to Londonderry where it was converted into pig iron. The company has also made test pits and strippings proving the existence of many large and valuable deposits of ore and in many places boulders and masses of both ankerite and limonite occur in sufficient quantities to warrant their collection.

"The plant of the company consists of :—

- 1 blast furnace, 50 ft. high, 6 ft. bell, 11 ft. bosh, daily capacity 25 tons.
- 2 horizontal blowers 5 ft. diameter, and 5 ft. stroke.
- 1 double set of engines 13 by 18 inch. cylinders operating blowers.
- 1 modified "Durham" cast-iron stove containing sixty 6-inch U tubes 13 ft. long.
- 4 boilers 30 ft. by 36 inches.

"The buildings consist of cast house, coal and ore sheds, engine and boiler-houses, compressor-house, stove-house, blacksmith shop, office and stables, and twenty charcoal kilns with a capacity of 660 cords. Railway communication is had by means of a half-mile siding from the N.G.I.C. & R. Company's tracks.

New Glasgow
Iron, Coal and
Railway Co.

The New Glasgow Iron, Coal and Railway Company.—"This company with works and headquarters at Ferrona near the junction of the East and West Branches of the East River were just about to put their furnace into blast at the time of my visit, 24th August. The works are those of a fully equipped blast furnace plant of about 80 tons daily capacity and consist of the following :—

- 1 blast furnace, 75 ft. high, 16 ft. bosh, 10 ft. crucible, 8 tuyeres.
- 3 Stoves (Massick and Crooke) 60 ft. by 16 ft. 6 inches.
- 8 boilers, totalling 900 h.p.
- 2 blowers, 36 inch cylinders, 84 inch tubs, 4 ft. stroke.

- 36 coke ovens, with pusher (Bernard patent, modified Belgian IRON.
 Coppee ovens), 33 feet long, 26 inches wide, capacity 80 tons Discovery and
 coke per day. development,
 Nova Scotia.
- 1 coal washing plant, 250 tons daily capacity (Schurtermann Im-
 proved Hartz jig), fine corn size.
- 1 double elevator and engine.
- 1 ore washer.

"The buildings consist of cast-house, engine and boiler-houses, coal washer shed, ore and coke shed, forge and office. The company also owns and operates the railroad running from Eureka Junction on the Intercolonial Railway to Black Rock, a distance of about twelve and a half miles.

"The company own or control a very large extent of iron-bearing territory on the East Branch, but at the time of my visit were operating on four properties only, the McDonald, Grant and Fraser farms, and at Black Rock further south.

McDonald Farm.—"On the McDonald farm they have sunk on the McDonald
 vein, which dips about 30° to the west, for about 450 feet, and from Farm.
 this slope several levels have been run in ore either way, the longest being to the southward, in which direction they have followed the vein for 250 feet. The vein, as seen in the slope, averages about nine feet, in places being as much as seventeen feet in thickness. It was found impossible to get even an approximate idea of the extent of the workings here, as the timbering in many places had been either removed or had fallen away and the workings abandoned. The work is of a necessity very irregular, and for the greater part consists in following the ore. The ore, as in most deposits on the East Branch, occurs between walls of clay and is oolitic in character, though in certain parts it is solidly botryoidal or fibrous. The workings here are very wet, a large pump with three-inch discharge barely sufficing to hold the water in check. The plant consists of steam hoisting gear, engine and pump.

"The ore from this slope afforded the following results on assay by Messrs. Stein and Schwarz of Philadelphia: *

Crude wash ore.

	Per cent.
Siliceous matter	9 38
Metallic iron	51 63

* This and the following assays of ore were made by Messrs. Stein and Schwarz for the N. G. Iron, Coal and Railway Co.

IRON. "This was washed affording 88 per cent coarse or washed ore and
Discovery and 12 per cent clay or loss. The washed ore and clay afforded the
development, Nova Scotia, following:

Washed ore.

	Per cent.
Siliceous matter.....	6.75
Metallic iron.....	58.41
Manganese	1.88
Combined water.....	11.02
Phosphorus	.016

Clay washed from ore.

	Per cent.
Siliceous matter.....	28.67
Metallic iron.....	38.58

The more solid or lump ore found in parts of this mine gave:—

Lump ore.

	Per cent.
Siliceous matter.....	8.18
Metallic iron.....	52.92
Phosphorus	.019
Sulphur.....	.069
Manganese	4.43
Combined water.....	10.50

Grant Farm. *Grant Farm.*—"The property next adjoining the above to the south and between that and the Charcoal Iron Company's property is the Grant farm, on which are two drifts and one shaft. The shaft is on the brow of the hill and is fifty-five feet deep, the upper twenty feet of which was through surface soil and clay, beneath which the ore was cut diagonally for a distance of thirty-five feet and bed rock struck immediately beneath. This consisted of a slaty rock of pre-Carboniferous age. The vein in the shaft had a thickness of from seven to eleven feet. The upper drift, down the hill and beneath the shaft, is 200 feet in length through clay and taps the vein at a distance of 180 feet where seven feet of good ore was found. The lower drift about fifty feet below the above was carried in about 250 feet. In this the part of the clay mass usually occupied by the vein was found to be practically barren of iron though small bunches and masses of ore were found. It is the intention to connect these workings by rising from the lower drift past the upper to the shaft so that the ore will all be

drawn from the lower drift and run on the level to the ore bin close Iron.
at hand on the company's tracks.

Discovery and
development,
Nova Scotia.

"The ore from this property afforded Messrs. Stein and Schwarz the following result :—

Ore from Grant Farm.

	Per cent.
Siliceous matter.....	5.58
Metallic iron.....	56.57
Phosphorus.....	.213
Sulphur.....	.096
Water.....	10.90

Fraser Farm.—"The next property to the southward operated by Fraser Farm. this company is the Fraser farm separated from the Grant farm by the Pictou Charcoal Iron Company's land. Here the operations consist of a shaft and drift. The shaft near the brow of the hill was sunk fifty feet to the vein, and from its base two levels have been run fifty feet in either direction on the vein. Lower down the hill a drift has been run fifty feet striking the vein, upon which they had begun to rise to the shaft. The vein here averages ten feet of good ore in walls of clay.

"All the workings from the McDonald farm through the Grant farm, Pictou Charcoal Company's workings and the Fraser farm would seem to be upon the same vein or contact deposit which follows in all its sinuosities the junction between the Lower Carboniferous and Devonian or Silurian strata.

Black Rock.—"At Black Rock, the present terminus of the railway, Black Rock. extensive bodies of ore occur in a somewhat similar manner to the foregoing and are probably but a continuation of them. Work here is carried on principally in an open-cut, about 150 feet above the track, where the ore is found beneath a slight covering of surface soil filling a small bay or indentation in the pre-Carboniferous rocks. Beneath the open cut a drift was run to the south-east on the vein for a distance of 200 feet, with at fifty feet from the mouth, a rise to the open cut, a distance of sixty feet, showing good ore throughout the rise. From these openings the ore is run on an incline to ore-bins on the railway. About seventy-five feet beneath the above a drift was run through limestone to strike the vein which was found at a distance of 450 feet. In this drift and about 150 feet from the entrance an elbow of the so-called "black rock" (diorite,} intrusive in the pre-Carboniferous) was struck, and the drift in consequence deflected somewhat from its direct course.

IRON.

Discovery and
development,
Nova Scotia.

"At the point of contact between the limestone and the 'black rock' no ore was found, but at the junction of the limestone and underlying rocks at the end of the drift the ore was found to be excellent both as to quality and quantity. It is the intention to rise from this lower drift and make it the main way of the workings.

"Analyses of the ore from Black Rock were made by Messrs. Stein and Schwarz with the following results:—

Fine Crude Ore from Black Rock.

	Per cent.
Siliceous matter.....	24.48
Metallic iron.....	41.70
Phosphorus.....	.043
Manganese.....	1.01

"The ore on being washed afforded 85 per cent. ore and 15 per cent. clay. The clay on analysis was found to contain 51.08 per cent. of siliceous matter, and 21.49 per cent metallic iron while the resultant washed ore afforded the following:—

Washed Ore from Black Rock.

	Per cent.
Siliceous matter.....	19.78
Metallic iron.....	45.27
Manganese.....	1.08
Phosphorus.....	.045
Water of hydration.....	11.10

"Besides that being carried on by the two companies mentioned, no work was being done on the East River, though large areas of iron lands are held by local and western capitalists."

The other mines working were those of the Londonderry Iron Company, and those of the Annapolis valley supplying ore to the same company.

New
Brunswick.

NEW BRUNSWICK.

Beyond a little prospecting work nothing was done in this province in the development of iron ore.

Quebec.

QUEBEC.

The mining of the bog iron ores of the province was continued by Messrs. Jno. McDougall & Co., of Montreal, for the supply of their smelting works at Drummondville, as well as by the Canada Iron Furnace Company under the direction of Mr. George E. Drummond.

The latter company have their works at Radnor Forges, Champlain Iron. county, and have been engaged in extending and improving their plant. Their works were not visited by any of the officers of the survey, but the report of the Commissioner of Crown Lands of the province gives the following interesting notes regarding operations. :—

“ In August, 1891, the work of demolishing the old furnace was begun, a new furnace was then constructed, and blown in March 12th, 1892. The present furnace is forty feet high, nine feet bosh. The metal shell is of boiler plate, supported by cast iron columns, and up to bosh line is stayed by a water jacket. The blast enters at a temperature of 750 degrees, pressure being $3\frac{1}{2}$ lbs through the four bronze tuyères. The air is heated with a hot blast stove on the pipe principle, and steam power is used in connection with the blast.

Discovery and
development,
Quebec.

Radnor
Forges.

“ The old fashioned blowing engines are being replaced by a modern Weimer engine of larger capacity, which will give increased quantity and pressure.

“ A battery of four boilers is fired with the waste gases from the furnace.

“ The ore used is procured from both sides of the river St. Lawrence, on the south shore at Gentilly and Becancour, on the north shore at Champlain, Pointe du Lac, Lanoraie, St. Felix de Valois, Joliette, and in the parishes near the Forges, county of Champlain. Large quantities are taken from Turtle lake by means of a dredge, and the deposits here seem to be inexhaustible. New discoveries are being made frequently. The company has at present in operation twenty-four kilns for producing charcoal which is sufficient for the furnace now. Eight of these are rectangular; the others are of the bee-hive pattern, capacity of each sixty cords, (twelve new ones at Grandes Piles.) About 200 men are employed in the manufacture proper; but when the men who raise the ore and get out the firewood are computed, the total number is certainly from 500 to 800 according to the season. The company's mark is C.I.F. The iron is divided into ten grades, from which can be selected material for the finest stove-plates, car-wheels, rolling-mill rolls, chill-plates, etc. Grandes Piles is being made a base for a large supply of wood and charcoal. The company has constructed one steamboat and three large scows, and three more are to be built. With these the wood is to be brought down river to the kilns at shipping point. The wood is procured on each side of the St. Maurice above Grandes Piles, and the supply is practically inexhaustible.

“ Since the furnace was blown in, the daily output has averaged about twenty-five tons, but with the new blowing apparatus it is expected to increase this to forty tons or more. The company have made

IRON. experiments with a magnetic ore and contemplate using the same.
 Discovery and The ore is procured from St. Jérôme.
 development, Quebec.

"This company has also in operation an extensive plant for the manufacture of ordinary and repressed brick, with a capacity of 2,000,000 per annum. The company propose enlarging this branch of business and contemplates supplying a regular line of fancy bricks.

"I direct attention to the remarkable development of this industry as there are only three other points in the Dominion of Canada where similar workings are carried on, viz : Drummondville, P.Q., Londonderry and New Glasgow, N.S.

"The old furnace, at Radnor, at its best, only produced five tons per day. This industry reflects most creditably on the province, as the product competes with foreign material in the open market, and owes success to its superior quality. Up to the present time the furnace product has been wholly utilized in Canada.

"From a local point of view this industry is of course very important, giving work to a large population, enabling a class of wood to be utilized, which otherwise the settlers would destroy by fire in order to clear the land for agricultural purposes.

Magnetic
sands of the
Gulf.

"Some attention has of late been given to the Magnetic Sands of the North Shore of the Gulf, and a small quantity was shipped to England for experimental purposes, but the result of same has not yet been declared."

Between them these two companies have nearly 1,000 men on their pay-rolls.

Some of the deposits mentioned above are alluded to in Mr. Giroux's summary report of the season's work as follows :—*

"The old mines and other points of interest about Joliette, Radstock, St. Alphonse and Chertsey were then examined ; the Canada Iron Furnace Company of Radnor has been working actively since the middle of September in ranges 3 and 4 of the township of Joliette, St. Ambroise parish, Joliette county. It was learned from the company's foreman that the deposit of bog iron ore on range three, township of Joliette, was one of the best yet worked by the company. It varies from twelve to eighteen inches in thickness and is about three chains wide by five chains long. This company has worked at a small deposit of magnetic iron ore in concession St. Charles, Rang Double, of the parish of Ste. Ursule, and expects to ship about 100 carloads of ore from St. Ambroise parish, and about forty carloads from the parish of Ste. Elizabeth."

* Summary Report of Geological Survey Department for 1892, p. 31.

Bristol Mine.—In Pontiac county, Messrs. Evans & Co., of Philadelphia, IRON. operated the Bristol Mine during four months of the year, employing Bristol mine. some sixty-five men. This ore, which is valued at \$1.00 per ton raw, or \$1.50 per ton roasted, is as in the past, all shipped to the United States.

ONTARIO.

Ontario.

None of the mines of this province were operated during the year.

BRITISH COLUMBIA.

British
Columbia.
Texada
Island.

Texada Island.—No work was done on the Texada Island mine during the year.

Glen Iron Mine.—The Glen Iron Mining Company operated their mine at Cherry Bluff, near Kamloops with a force of about twenty men. The ore was all exported, being sent to Tacoma in Washington State and to Portland and Oswego in Oregon. Glen iron mine.

Mr. McEvoy of the Survey staff visited this mine, regarding which he makes the following observations :—*

“Before returning the Glen iron mine on Kamloops lake was visited. The ore is magnetite throughout, with a slight mixture of calcite and felspar in a few places, which, however, does not injure the ore for smelting. The following items were noted :—

“1. An opening a few feet from the railway, filling an irregular angular fissure from two to six feet in width.

“2. Three hundred feet south of last a deposit of four feet of good ore, with five feet mixed ore and country rock.

“3. Five hundred feet southward from last a large deposit of fourteen feet good ore, with ten feet of mixed.

“4 Thirty feet north-west of last, twelve feet of ore.

“5. West of last a vein three feet thick.

“6. South-west of last numerous croppings of good ore undeveloped. At a low estimate ten per cent of the mass here is ore.

“7, North-east of No. 3 a vein four to ten feet thick. This is the principal source of output at present and is connected with the railway by an aerial tramway.

“All the veins run in an easterly and westerly direction and are nearly vertical or dipping northward at high angles.”

* Summary Report of Geological Survey Department for 1892, p. 31.

IRON.

Pig iron and steel.

Pig Iron and Steel.

As mentioned above there were 103,248 tons of iron ore produced from all the mines of the Dominion. Of this quantity 96,948 tons were used in the country. This amount represents the ore fed to the furnaces of the following operators, viz. :—

The New Glasgow Iron, Coal and Railway Co., Ltd.	} In Nova Scotia,
The Londonderry Iron Company, Ltd.	
The Pictou Charcoal Iron Company, Ltd.	
The Canada Iron Furnace Company, Ltd.	} In Quebec.
Messrs. John McDougall & Co.	

The number of furnaces in blast during the year was five, of which three used charcoal for fuel and two coke with a little raw coal.

The following table, No. 3, gives further details :

Pig iron.

IRON.

TABLE 3.

PIG IRON PRODUCTIVE: CONSUMPTION OF ORE, FUEL, ETC.

Materials made and used.	1891.		1892.	
	Quantity.	Value.	Quantity.	Value.
Pig iron made.....Tons.	23,891	\$368,901	42,443	\$637,421
Iron ore consumed....."	60,933	130,955	96,948	250,966
Charcoal. Bush.	441,812	22,091	1,121,365	78,291
Fuel consumed { Coke.....Tons.	30,628	98,402	50,882	152,311
Coal....."	2,170	2,868	1,740	1,797
Flux consumed....."	11,377	11,546	22,967	21,687

Table No. 4 gives the exports of iron and steel goods from Canada, and tables 5, 6 and 7 following give data regarding the country's consumption of similar commodities whose value is based chiefly upon the amount of iron they contain than upon their highly manufactured condition.

IRON.
TABLE 4.

EXPORTS OF IRON AND STEEL GOODS THE PRODUCE OF CANADA.

Province.	Pig Iron.	Iron Stoves.	Scrap Iron.	Iron Castings.	Iron, all other and hard-ware.	Steel and manufactures of.	1892 Totals.	1891 Totals.
Ontario.....		\$691	\$1,043	\$5,146	\$10,441	\$17,498	\$34,819	\$27,436
Quebec.....	\$330	187	605	4,518	54,319	9,792	69,751	53,039
Nova Scotia.....		2,419	882	287	15,887	25,403	44,878	63,738
New Brunswick.....					4,232		4,232	5,602
Prince Edward Isl'd.....		3			129		132	14
Manitoba.....		152		8	94	544	798	344
North-west Ter's.....			344	22	62		428	
British Columbia.....		55	192		29	283	559	2,746
Totals.....	\$330	\$3,507	\$3,066	\$9,981	\$85,193	\$53,520	\$155,597	\$152,919

IRON.
Exports of
iron and steel.

IRON.
TABLE 5.
IMPORTS OF PIG IRON, ETC.

FISCAL YEAR.	PIG IRON, CHAR-COAL.		PIG IRON, ALL OTHER.		PIG IRON, KENTLEDGE, ETC.		TOTAL	
	Tons.	Value.	Tons.	Value.	Tons.	Value.	Tons.	Value.
1880.....			23,159	\$371,956			23,159	\$371,956
1881.....			43,630	715,997			43,630	715,997
1882 ..	6,837	\$211,791	56,594	811,221			63,431	1,023,012
1883.....	2,198	58,994	75,295	1,085,755			77,493	1,144,749
1884 ..	2,893	66,602	49,291	653,708			52,184	720,310
1885.....	1,119	27,333	42,279	545,426			43,398	572,759
1886 ..	3,185	60,086	42,463	528,483			45,648	588,569
1887....	3,919	77,420	46,295	554,388			50,214	631,808
1888.....					48,973	\$648,012	48,973	648,012
1889.....					72,115	864,752	72,115	864,752
1890.....					87,613	1,148,078	87,613	1,148,078
1891 ..					81,317	1,085,929	81,317	1,085,929
1892.....					68,918	886,485	68,918	886,485

IRON.

Exports of
iron and steel.

IRON.

TABLE 6.

IMPORTS : IRON IN SLABS, BLOOMS, LOOPS AND PUDDLED BARS, ETC.

Fiscal Year.	Cwt.	Value.
1880.....	195,572	\$244,601
1881.....	111 666	111,374
1882.....	203,888	222,056
1883.....	258,639	269,818
1884.....	252,310	264,045
1885.....	312,329	287,734
1886.....	273,316	248,461
1887.....	522,853	421,598
1888.....	110,279	93,377
1889.....	80,383	67,181
1890.....	15,041	15,923
1891.....	41,567	38,931
1892.....	64,397	56,186

IRON.

TABLE 7.

IMPORTS OF IRON AND STEEL GOODS.*

Fiscal Year.	Value.
1880.....	\$6,620,260
1881.....	8,484,175
1882.....	8,578,685
1883.....	8,613,739
1884.....	6,143,870
1885.....	4,606,193
1886.....	4,698,882
1887.....	6,084,704
1888.....	5,147,111
1889.....	7,108,052
1890.....	7,260,845
1891.....	9,188,502
1892.....	9,509,489

LEAD.

LEAD.

Production.

PRODUCTION.

The amount of this metal produced during 1892 shows a large increase as compared with previous years, the figures being as follows:—

1890.....	113,000 lbs. valued at \$	5,805
1891.....	588,665	" 25,607
1892.....	1,768,420	" 72,505

Practically the whole of this production is to be credited to British LEAD. Columbia and represents the lead contents of the galena ores shipped from that province.

All the lead production of the country is shipped as ore, there being no smelters in operation.

EXPORTS AND IMPORTS.

Exports and imports.

LEAD.

TABLE 1.

IMPORTS OF LEAD.

FISCAL YEAR.	OLD, SCRAP AND PIG.		BARS, BLOCKS, SHEETS.		TOTAL.	
	Cwt.	Value.	Cwt.	Value.	Cwt.	Value.
1880					30,298	\$124,117
1881	16,236	\$ 56,919	18,222	\$70,744	34,458	127,663
1882	36,655	120,870	10,540	35,728	47,195	156,598
1883	43,780	143,759	8,591	28,785	57,371	177,544
1884	39,409	103,413	9,704	28,458	49,113	131,871
1885	36,106	87,038	9,362	24,396	45,468	111,434
1886	39,945	110,947	9,793	28,948	49,738	139,895
1887	61,160	173,477	14,153	41,746	75,313	215,223
1888	63,678	196,845	14,957	45,900	83,635	242,745
1889	74,223	213,132	14,173	43,482	88,396	256,614
1890	101,197	283,096	19,083	59,484	120,280	342,580
1891	86,382	243,033	15,646	48,220	102,028	291,253
1892	97,375	254,384	11,299	32,368	108,674	286,752

LEAD.

TABLE 2.

IMPORTS OF LEAD MANUFACTURES.

Fiscal Year.	Value.
1880	\$15,400
1881	22,629
1882	17,232
1883	25,556
1884	31,361
1885	36,340
1886	33,078
1887	19,140
1888	18,816
1889	16,315
1890	25,600
1891	23,893
1892	22,636

LEAD.

DISCOVERY AND DEVELOPMENT.

Discovery and development.

Regarding discovery and development nothing of importance was done in this metal in the eastern provinces.

Nova Scotia. NOVA SCOTIA.

Mr. Brumell when in the province of Nova Scotia found opportunity to visit one lead deposit regarding which he furnishes the following notes :—

Colchester County

Smithfield. *Smithfield.*—"A visit was made during the summer to this property which is now held by Messrs. C. F. Fraser, Howard Clark, *et al* of Halifax. Although the shafts were full of water and the property idle for some time there was every evidence of considerable work having been done. I was informed that the underground work consisted of two shafts thirty and sixty feet deep. From the bottom of the thirty feet shaft a cross-cut has been run from the foot-wall a distance of thirty-three feet to the south, traversing good ore throughout, but falling short of reaching the hanging wall. From the easterly or sixty feet shaft two drifts had been run on the vein in either direction to a distance of thirty feet each.

"The vein with an estimated thickness of thirty feet strikes approximately east and west and dips at an angle of 80° or 85° to the south, the country rock consisting of Carboniferous limestone, striking N. 75° W. The ore consists of fine and coarse grained argentiferous galena associated with iron-pyrites, calcite and small quantities of light coloured zinc-blende and, it is said, can be dressed to 16 per cent pure galena.

"A small furnace was erected at the mine but proved unsuccessful.

"The following analyses of ore from the property are available :—

I. Assay of ore by E. Gilpin, jr., Halifax.

II. " pure galena " "

III. " ore by " "

IV.-V. " " Johnson Matthey & Co., London.

VI. " " Ledoux & Ricketts, New York.

I.

II.

Lead, 975 lbs. to ton of ore.	1,600 lbs. to ton of galena.
Silver, 10 ozs. " lead.	34 ozs. " lead.
Gold traces.	Not found.

III.	IV.	V.	LEAD.
Lead, 42 per cent.	65·5 per cent	22 per cent.	Discovery and development,
Silver, 2½ ozs. to ton of lead.	15 dwts.	10 dwts.	
Gold, trace.	Trace.	Trace.	

VI.

Lead, { 40 per cent wet analysis.
38·84 per cent smelting.

Silver, trace.

Gold, none.

"It is expected that the Stewiacke Valley and Lansdowne Railway will shortly complete its projected line when the property will be within two miles of railway communication."

BRITISH COLUMBIA.

British
Columbia.

In this province the working of the veins carrying argentiferous galena situated in its south-eastern portion forms an important new feature. For many years past veins of this character had been known to exist in various parts of the districts of East and West Kootenay and Yale. In some camps the galena was accompanied by sulphurets of iron and of copper and often by blende, the proportion of these minerals varying very considerably in different veins. In previous years more or less development work was done on these veins notably in the sub-districts of Illecillewaet, Nelson and Ainsworth of West Kootenay and at various places in Yale as well as in East Kootenay, but the great feature of 1892 was the discovery and development of very many veins in the new Slocan district, situated about twenty miles north of Nelson, between Kootenay and Arrow Lakes, about ten miles west of the latter. The first discovery was made late in the previous fall and, the ore being found to assay well in silver, a rush was made in the spring which led to very numerous discoveries and great activity in the district during 1892, which resulted in the shipments of ore, the lead contents of which figure above under the head of production.

The ore thus shipped all went to smelters in the western States and consisted for the most part of solid galena selected from the ore mined

Further details regarding this district are to be found in the article on precious metals following.

Besides the Slocan district above mentioned, important work was done in the discovery and development of galena bearing veins in the Fish River valley tributary to Illecillewaet on the Canadian Pacific Railway, and in the Lardeau River country, Goat River, Trail Creek Ainsworth and various other places in West Kootenay.

LEAD.
Markets.

Markets.—Practically all the lead ore produced in Canada has so far found a market in the United States, but by reason of the duty on lead none but ores rich in silver can be shipped there at a profit.

The home market is not large, some idea of its extent being gained by a study of the tables Nos. 1 and 2 previously given.

MANGANESE.

MANGANESE.

Production.

PRODUCTION.

The quantity of manganese produced during the year was 115 tons, valued at \$10,250, all the production of Nova Scotia. The production of the year previous was not obtained direct from the operators, but was supposed to have been represented by the exports which were 255 tons valued at \$6,694. If that amount properly represents the output for the year 1891, there was in 1892 a falling off of 140 tons, while the value increased \$3,556. This increase is no doubt due to the re-opening of the Teny Cape mines and the shipment of high-grade ore therefrom.

Exports and
imports.

EXPORTS AND IMPORTS.

The following tables illustrate the exports and imports during the past few years :—

MANGANESE.

TABLE 1.

EXPORTS OF MANGANESE ORE PRIOR TO 1873.

FISCAL YEARS.	NOVA SCOTIA.		NEW BRUNSWICK.		TOTAL.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
1868.....	156	\$4,700	861	\$19,019	1,017	\$23,719
1869.....	156	4,695	332	6,174	488	10,869
1870.....	1,256	4,102	146	3,580	1,402	7,682
1871.....	102	1,608	954	8,180	1,056	9,788
1872.....	131	4,005	1,075	24,495	1,206	28,500
1873.....	.....	.....	838	17,171	838	17,171

MANGANESE.
TABLE 2
EXPORTS OF MANGANESE ORE.

MANGANESE.
Exports and
imports.

YEARS.	NOVA SCOTIA.		NEW BRUNSWICK.		TOTAL.	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
1873.....			1,081	\$20,192	1,081	\$20,192
1874.....	6	\$ 12	776	16,961	782	16,973
1875.....		200	194	5,314	203	5,514
1876.....	21	723	391	7,316	412	8,039
1877.....	106	3,699	785	12,210	891	15,909
1878.....	106	4,889	520	5,971	626	10,860
1879.....	154	7,420	1,732	20,016	1,886	27,436
1880.....	79	3,090	2,100	31,707	2,179	34,797
1881.....	200	18,022	1,504	22,532	1,704	40,554
1882.....	123	11,520	771	14,227	894	25,747
1883.....	313	8,635	1,013	16,708	1,326	25,343
1884.....	134	1,054	469	9,035	603	20,089
1885.....	77	5,054	1,607	29,595	1,684	34,649
1886.....	(a) 441	854	1,377	27,484	(a) 1,818	58,338
1887.....	578	14,240	837	20,562	1,415	34,802
1888.....	87	5,759	1,094	16,073	1,181	21,832
1889.....	59	3,024	1,377	26,326	1,436	29,350
1890.....	177	2,583	1,729	34,248	1,906	36,831
1891.....	22	563	233	6,131	255	6,694
1892.....	84	6,180	59	2,025	143	8,205

(a) 250 tons from Cornwallis should more correctly be classed under the heading of mineral pigments.

MANGANESE.
TABLE 3.
IMPORTS: OXIDE OF MANGANESE.

Fiscal Year.	Pounds.	Value.
1884.....	3,989	\$ 258
1885.....	36,778	1,794
1886.....	44,967	1,753
1887.....	59,655	2,933
1888.....	65,014	3,022
1889.....	52,241	2,182
1890.....	67,452	3,192
1891.....	92,087	3,743
1892.....	76,097	3,530

DEVELOPMENT AND DISCOVERY.

Discovery and
development.

There is little to report upon in the industry during the year, the following observations made by Mr. H. P. Brumell being all the available data :—

MANGANESE. NEW BRUNSWICK.

Discovery and
development
in New
Brunswick.
Albert.

Albert County.

Albert.—"About two miles and a half west of Albert village and north of the main road to Alma a property under lease to C. J. Butcher, *et al* of Moncton was being actively prospected for manganese with but slight success. Several test pits have been sunk, in some of which small quantities of high-grade ore have been found. On the southern limit of the lease a large body of ore was opened up some years ago and a considerable quantity extracted and shipped. This fact, combined with the prevalence of large masses of "float" manganese to the northward and higher up the hill, led the lessees to undertake the present operations. The rocks of the vicinity are sandstone interstratified with limestone, in which latter it is expected will be found paying quantities of ore. The ore so far found is high-grade pyrolusite with manganite."

Dawson
settlement.

Dawson Settlement.—"The works erected here for the drying of the bog-ore found in the vicinity were idle during the year, nor is it expected, at least until the plant is improved, that active operations will be again undertaken. The plant at present consists of three drying pans twelve by forty feet, each heated by two flues running the entire length of the pans and feeding into one smoke-stack about twenty feet high, the whole being well planned for the creation and maintenance of a high drying temperature. The pans are placed in a frame building containing also the dry-ore bins, alongside of which is a spur from the Salisbury and Harvey Railway, owned and operated by the same company. A wagon road has also been built from the works to the main-road between Hillsboro' and Salisbury. In the ore deposit, a considerable amount of cross-trenching has been done without, however, very materially draining the mass.

"The suspension of operations is due to the inability of the producer to thoroughly dry the ore and consequently keep up per centages, there is no reason, however, why, with improved methods, the ore should not be dried and 48 to 55 per cent stuff shipped in large quantities."

Nova Scotia. NOVA SCOTIA.

Teny Cape.

Hants County.

Teny Cape.—"Operations were resumed at this well-known locality by A. E. Shaw, *et al* of Windsor, and good ore was being extracted. Several new veins have been found ranging in width from six inches to three feet and consisting of pure pyrolusite. The three feet vein was being worked in the bottom of the old 250 feet shaft with good results.

Colchester County.

MANGANESE.

Onslow.—"A visit was made to this property which has for some years lain idle, in consequence of which the several test pits and the large open cut were full of water. The work done shows the ore to occur as thin plates and small bunches in a slaty sandstone, striking N. 25° E. and dipping <45° S.E. No ore was visible in the sandstone above the water in the pits. A small mill containing three jigs, engine and upright boiler was erected some time ago, but having been idle for over two years has fallen somewhat into decay. The dressed ore found in barrels in the mill consisted of low grade manganite and psilomelane."

Discovery and
development
in Nova Sco-
tia. Onslow.

Cape Breton County.

Loch Lomond.—"Operations were being carried on as usual at this place under the proprietorship of Hon. E. T. Moseley, Q.C., of Sydney, who reported the markets and prospects good. The ore which is pyrolusite and manganite is all shipped from Big Pond, C.B., the greater proportion going to the United States."

Loch Lomond.

MICA.

MICA.

PRODUCTION.

Production ,

The production of mica still shows an increase over that of previous years, the value of the mineral produced and sold for 1892 being \$104,745 as against \$71,570 for 1891, or an increase of over 46 per cent on last year's figures.

The production for past years is given below :—

1886.....	\$ 20,008
1887.....	20,816
1888.....	30,207
1889.....	28,718
1890.....	68,074
1891.....	71,510
1892.....	104,745

It is very difficult to get at an exact figure of production as mining is carried on by so many small operators scattered all over the mica producing districts who sell to the larger operators, and to the travelling buyers of the electrical companies, thereby rendering it impossible to get direct returns from them all. The above figures therefore represent the export returns to which have been added the values of the mica used in Canada by the various electrical manufacturers.

MICA.

It is in this direction that this mineral finds its chief use, and the sudden increase in the production after 1889, as shown above, was due to the demand that then arose for the varieties of phlogopite and biotite suitable for this purpose. Previous to that time the mica mined was nearly all muscovite for stove manufacture and other purposes.

A small amount of the refuse clippings from the cutting and trimming of the crystals is ground and sold to manufacturers of lubricants and used in wall paper manufacture, etc.

Other details regarding this industry are to be found in the previous publications of this division.

Exports and imports.

EXPORTS AND IMPORTS.

There were exported 1,338,570 pounds of crude and cut mica valued at \$79,845 with \$6,717 worth of the ground mineral from Quebec. The exports are credited to the various provinces as follows :—

Ontario.....	1,330,966,	valued at \$77,757 to United States.
Quebec.....	5,410,	" 1,473 "
"	2,194,	" 615 to Great Britain.
" (ground)	"	6,717

\$ 86,562

During the past few years the exports have been as follows :—

1887.....	\$ 3,480
1888.....	23,563
1889.....	30,597
1890.....	22,468
1891.....	37,590
1892.....	86,562

Discovery and development in Quebec.

DISCOVERY AND DEVELOPMENT.

QUEBEC.

In this province the mica mined was got as formerly from deposits in the River Gatineau and River du Lièvre districts in Ottawa county. Mr. Giroux of the survey staff speaks of a deposit near Lake Cutaway, DeMaisonneuve, Berthier county as occurring in a dyke of coarsely crystalline felspar and quartz where although the mineral is of good colour, the crystals are so intermixed and twisted as to make the deposit of little value.

Discoveries of mica have been reported from other parts of the province, notably Pontiac, Argenteuil, Berthier, Chicoutimi, Charlevoix, etc., but no developments of any importance have been made.

In the eastern part of this province, in the Laurentian rocks, the MICA known occurrences are very numerous, but only a few of them were worked during the year, and there is nothing of importance to note about the work done.

MINERAL PIGMENTS.

MINERAL
PIGMENTS.
Ochres.

Ochres.—The production of ochres during the year was 390 tons valued at \$5,800, a decrease compared with 1891 of 510 tons and in value of \$11,950. The following figures show the production during the past few years:—

1887.	385 tons	valued at \$2,233
1888.	397	" 7,900
1889.	794	" 15,280
1890.	275	" 5,125
1891.	900	" 17,750
1892.	390	" 5,800

There is nothing new to report regarding the industry, operations being carried on as in previous years. Mr. N. J. Giroux in the summary report of the Geological Survey for 1892 mentions an occurrence as follows:—

"On the east shore of Rivière du Milieu and about three miles and a half north-west of Lac des Pins, there is a deposit of iron ochre of indian red and vandyke brown colours which has been worked by Mr. Gaucher, of Montreal, who had a few tons of it dried and sent to him to test, but no work has been done lately."

Rivière du
Milieu.

There are no figures of exports available nor is it thought any were made. The following table illustrates the imports during recent years:—

MINERAL PIGMENTS.
TABLE 1.
IMPORTS OF OCHRES.

Fiscal Year.	Pounds.	Value.
1880.	571,454	\$ 6,544
1881.	677,115	8,972
1882.	731,526	8,202
1883.	898,376	10,375
1884.	533,416	6,393
1885.	1,119,177	12,782
1886.	1,100,243	12,267
1887.	1,460,128	17,067
1888.	1,725,460	17,664
1889.	1,342,783	12,994
1890.	1,394,811	14,066
1891.	1,528,696	20,550
1892.	1,708,645	22,908

MINERAL
PIGMENTS.
Baryta.

Baryta.—During the year there were 315 tons of baryta marketed having a value of \$1,260. For the past seven years the production has been as follows:—

1886.....	3,864 tons, valued at \$19,270
1887.....	400 " 2,400
1888.....	397 " 7,900
1889.....	none " none
1890.....	1,842 " 7,543
1891.....	none " none
1892.....	315 " 1,260

The following table illustrates the imports during past years. No figures of exports are available:—

MINERAL PIGMENTS.

TABLE 2.

IMPORTS OF BARYTA.

Fiscal Year.	Cwt.	Value.
1880.....	2,230	\$1,525
1881.....	3,740	1,011
1882.....	497	303
1883.....		185
1884.....		229
1885.....	7	14
1886.....		62
1887.....	379	676
1888.....	236	214
1889.....	1,332	987
1890.....	1,322	978
1891.....		
1892.....		

Litharge.

Litharge.—This material is not produced in Canada, the only available figures are therefore those of imports, which are as follows:—

MINERAL PIGMENTS.

TABLE 3.

IMPORTS OF LITHARGE.

Fiscal Year.	Cwt.	Value.
1880.....	3,041	\$14,334
1881.....	6,126	22,129
1882.....	4,900	16,651
1883.....	1,532	6,173
1884.....	5,235	18,132
1885.....	4,990	16,156
1886.....	4,928	16,003
1887.....	6,397	21,865
1888.....	7,010	23,808
1889.....	8,089	31,082
1890.....	9,453	31,401
1891.....	7,979	27,613
1892.....	10,384	34,343

MINERAL WATERS.

PRODUCTION.

MINERAL
WATERS.
Production.

The production of mineral water during the year was 640,380 gallons having a value of \$75,348, the increase over the year previous being in quantity 212,895 gallons and in value \$21,080.

The production during the past five years according to returns made to this office was :—

1888.....	124,850 gallons.....	\$ 11,456
1889.....	424,600 “	37,360
1890.....	561,165 “	66,031
1891.....	427,485 “	54,268
1892.....	640,380 “	75,348

The springs producing during the year according to replies received at this office were :—

Winchester Springs	W. J. Anderson, M.D., Smith's Falls, Ont.
Victoria Sulphur Springs	F. O. Ring, Ottawa, Ont.
Borthwick's	“ W. Borthwick, Ottawa, Ont.
Southampton	“ F. C. Carey, Southampton, Ont.
Hawthorne	“ J. Langstaff, Thornhill, Ont.
Georgian Saline	“ W. K. Kains, Treadwell, Ont.
Ancaster	“ R. A. Smith, Toronto, Ont.
Eudo	“ L. Forest, Toronto, Ont.
Blue Mountain	“ E. Wensley, Camperdown, Ont.
Preston Mineral	“ John C. Kress, Preston, Ont.
Eastman's	“ J. Boyd & Son, Eastman's Springs, O.
Caledonia	“ Grand Hotel Co., Caledonia Springs, Ont.
Richelieu	“ } J. H. M. Harte, Montreal, Que.
Ste. Geneviève	“ }
St. Leon	“ St. Leon Mineral Water Co., St. Leon Springs.
Divina	“ E. Lemire, St. Sévere, Que.
St. Hyacinthe	“ La Cie d'eau Minérale de St. Hyacinthe, Que.
Havelock	“ Havelock Mineral Co., Petitcodiac, N.B.
Apohaqui	“ Jno. R. Smith, St. John, N.B.
Spa	“ Wilmot Spa Springs, Middleton, N.S.

During 1892 “The New Toronto Oil and Natural Gas Co.” in one of their wells sunk near Islington obtained a useful mineral water

MINERAL
WATERS.
"Obico"
water.

which has been placed on the market under the name of "Obico Mineral Water," of which the following analysis by Mr. Thos. Heys of Toronto, is available.

Carbonate of iron.....	5.887
Chloride of sodium.....	822.000
" potassium.....	87.982
" calcium.....	2,820.980
" magnesium.....	730.750
" ammonium.....	55.073
Sulphate of magnesium.....	56.940
Carbonate of calcium.....	106.533
Phosphate of sodium.....	2.400
Organic ammonia.....	.070
Silica and alumina.....	3.920

Total grains in imperial gallon.... 4,692.535

The various mineral waters lately put upon the market in Ontario, such as the "Obico" mentioned above, the "Eudo" from Brechin on Lake Simcoe and a water from Southampton seem to have created a very good impression, and the producers report a marked increase in the demand. For table use many of the Canadian mineral waters are largely replacing those from the celebrated Apollinaris and other European springs.

Exports and
imports.

EXPORTS AND IMPORTS.

No figures of exports are available. The imports are according to the following table :—

MINERAL WATERS.
TABLE 1.
IMPORTS.

Fiscal Year.	Value.
1880.....	\$15,721
1881.....	17,913
1882.....	27,909
1883.....	28,130
1884.....	27,879
1885.....	32,674
1886.....	22,142
1887.....	33,314
1888.....	38,046
1889.....	30,343
1890.....	40,802
1891.....	41,797
1892.....	55,763

MISCELLANEOUS.

MISCELLANEOUS.

PRODUCTION.

Production.

In the following table will be found the production during 1892 of various articles, which, for convenience, will be treated of under this heading.

MISCELLANEOUS.

TABLE 1.

PRODUCTION.

Product.	1891.		1892.	
	Quantity.	Value.	Quantity.	Value.
Felspar..... Tons.	685	\$3,425	175	\$ 525
Fireclay..... "	250	750	1,991	4,467
Moulding sand..... "	230	1,000	345	1,380
Platinum.....		10,000		3,500
Precious stones.....		1,000		1,000
Soapstone..... Tons.			1,374	6,240

Felspar.—As may be seen, the production of this material has fallen off very considerably since 1891 when shipments were being made from a deposit near Rideau Lake in Ontario. The many large deposits of felspar known to exist in Canada are not as yet being worked owing to lack of rail communication. This, however, is being rapidly remedied and it is expected that in the future large quantities will be annually produced.

The production during the past three years was as follows :—

1890.....	700 tons, valued at \$3,500
1891.....	685 " " 3,425
1892.....	175 " " 525

There are no figures of exports or imports available.

Fireclay.—This production is altogether that of Nova Scotia, as it has been in the past.

The quantities produced yearly since 1889 are as follows :—

1889.....	400 tons, valued at \$4,800
1890.....	Not reported.
1891.....	250 tons, valued at 750
1892.....	1,991 " " 4,467

MISCELLANEOUS.
Moulding
sand.

Moulding Sand.—This material has up to the present year been reported only from Nova Scotia, although it is known to be produced at many points in Ontario and Quebec, principally for local use. The production during past years as reported to this office is as follows :—

1887.	160 tons, valued at	\$800
1888.	169 " "	845
1889.	170 " "	850
1890.	320 " "	1,410
1891.	230 " "	1,000
1892.	345 " "	1,380

Platinum.

Platinum.—The production of this metal as reported is altogether that of British Columbia, and is taken from the reports of the Minister of Mines of that province, which show the output to have been in past years as follows :—

1887.	\$5,600
1888.	6,000
1889.	3,500
1890.	4,500
1891.	10,000
1892.	3,500

The following notes regarding this metal are taken from the report of the Minister of Mines of British Columbia :—

"It will be noticed that the yield for the season, estimated at \$3,500, falls far short of the amount (\$10,000) mined in 1891. A decline in the market value of the metal is offered in explanation of the reduced production. There is reason, however, to think that certain claims on the Tulameen River, in the southern portion of the Yale Division, which have been acquired by the Tulameen Hydraulic Company, have not received the same attention during the past season as of late years. An amount exceeding \$20,000 has already been expended in the development of the property, and steps are now in progress for the purpose of obtaining the necessary capital to work the claims to advantage. Should the company succeed in their efforts mining operations will be resumed without delay on an extensive scale."

The following table shows the imports of this metal in all forms. MISCELLANEOUS.
No exports were reported.

MISCELLANEOUS.

TABLE 2.

IMPORTS OF PLATINUM.

Fiscal Year.	Value.
1883.....	\$ 113
1884.....	576
1885.....	792
1886.....	1,154
1887.....	1,422
1888.....	13,475
1889.....	3,167
1890.....	5,215
1891.....	4,055
1892.....	1,952

Precious Stones.—Under this heading are included all cut and polished Canadian gem stones and certain ornamental ones such as agate, perthite, peristerite, jasper and jasper conglomerate. The cut gems include asteriated quartz, sodalite, garnet, labradorite, etc.

The imports of precious stones, including diamonds, imported during the fiscal year ending 30th June, 1892, were \$63,738.

Soapstone.—The production of this material during 1892 shows a marked increase over that of the various years since 1886 when returns were first received by this department. The material is used in Canada altogether in the manufacture of roofing cement.

The production during the past seven years was as follows :—

1886.....	50 tons, valued at..\$	400
1887.....	100 " " ..	800
1888.....	140 " " ..	280
1889.....	195 " " ..	1,170
1890.....	917 " " ..	1,239
1891.....	None produced.....	
1892.....	1,374 tons, valued at	6,240

Whiting and Chalk.—Whiting was not produced during the year nor has any been manufactured in Canada since 1890 when the production was 500 barrels. During the fiscal year of 1892 there were \$26,867 worth imported.

MISCELLANEOUS.
Whiting and
Chalk.

Chalk is not found in Canada, so that no data are available except the figures of imports, which are shown in the following table :—

MISCELLANEOUS.

TABLE 3.

IMPORTS OF CHALK.

Fiscal Year.	Value.
1880.....	\$2,117
1881.....	2,768
1882.....	2,881
1883.....	5,067
1884.....	2,589
1885.....	8,003
1886.....	6,583
1887.....	5,635
1888.....	5,865
1889.....	5,336
1890.....	7,221
1891.....	8,193
1892.....	9,568

The following table illustrates the imports of whiting during past years :—

MISCELLANEOUS.

TABLE 4.

IMPORTS OF WHITING.

Fiscal Year.	Cwts.	Value.
1880.....	84,115	\$26,092
1881.....	47,480	16,637
1882.....	36,270	16,318
1883.....	76,012	29,334
1884.....	76,268	28,230
1885.....	67,441	23,492
1886.....	65,124	25,533
1887.....	47,246	15,191
1888.....	76,619	20,508
1889.....	84,658	22,735
1890.....	96,243	27,471
1891.....	84,679	27,504
1892.....	102,985	26,867

Arsenic.—There was no production of arsenic during 1892, the operations at Deloro, Hastings County, Ontario, having ceased in the fall of the previous year. MISCELLANEOUS.
Arsenic.

During past years since 1885 the production was as follows :—

1885.....	440 tons,	valued at \$17,600
1886.....	120 "	" 5,460
1887.....	30 "	" 1,200
1888.....	30 "	" 1,200
1889.....	None.	" None.
1890.....	25 "	" 1,500
1891.....	20 "	" 1,000

The following table illustrates the imports during past years ; no exports are reported.

MISCELLANEOUS.

TABLE 5.

IMPORTS OF ARSENIC.

Fiscal Year.	Pounds.	Value.
1880.....	18,197	\$ 576
1881.....	31,417	1,070
1882.....	138,920	3,962
1883.....	51,953	1,812
1884.....	19,337	773
1885.....	49,080	1,566
1886.....	30,181	961
1887.....	32,436	1,116
1888.....	27,510	1,016
1889.....	69,269	2,434
1890.....	138,509	4,474
1891.....	115,248	4,027
1892.....	302,958	9,365

Mercury.—This metal has not as yet been produced in Canada, though several deposits of the ore are known to occur. Of one of these Mr. E. D. Ingall, in the summary report of the Geological Survey for 1892, writes as follows :—

“The cinnabar deposit, on the north shore of Kamloops Lake, near the mouth of Copper Creek, about six miles from the western end of the lake, was visited on the 26th of October. Kamloops Lake.

“Here, owing to the recentness of the discovery, the work done on the veins has not been extensive, consisting only of shots and shallow pits on the outcroppings. The area visited was covered by the Rosebush claim, in which several spar and quartz veins are to be seen, averaging about a foot or so in width ; on these, at a number of points, very

MISCELLANEOUS.

encouraging showings of ore have been exposed, justifying the hope that still better results might be achieved by extensive developments. The cinnabar itself occurs in such a manner in the gangue in ribs, etc., that by hand picking a high grade of ore can be easily selected, and no difficulty was found in procuring handsome specimens for the museum."

The following table illustrates the imports of refined mercury, and is the only statistical information available :—

MISCELLANEOUS.
TABLE 6.
IMPORTS OF MERCURY.

Fiscal Year.	Pounds.	Value.
1882.	2,443	\$ 965
1883.	7,410	2,991
1884.	5,848	2,441
1885.	14,490	4,781
1886.	13,316	7,142
1887.	18,409	10,618
1888.	27,951	14,943
1889.	22,931	11,844
1890.	15,912	7,677
1891.	29,775	20,223
1892.	30,936	15,038

Tin.

Tin.—The following table illustrates the imports of tin and all manufactures of tin and constitutes all the information available regarding this metal in Canada :—

MISCELLANEOUS.
TABLE 7.
IMPORTS OF TIN AND TINWARE.

Fiscal Year.	Value.
1880.	\$ 281,890
1881.	413,924
1882.	790,285
1883.	1,274,150
1884.	1,018,493
1885.	1,060,883
1886.	1,117,368
1887.	1,187,312
1888.	1,164,273
1889.	1,243,794
1890.	1,289,756
1891.	1,206,918
1892.	1,594,205

Zinc.—Although no production is reported of this metal, active MISCELLANEOUS.
exploratory work was being carried on at the "Lawn Mine" on Zinc.
Calumet Island, Pontiac county, Quebec. Assays of the ore show it to contain from 39 to 54% of zinc with 15% of lead and 12 oz. of silver to the ton. In the report of the Commissioner of Crown Lands of the Province of Quebec for 1892, Mr. J. Obalski, mining engineer to the province, reports as follows on this deposit :—

"The Lawn mine situated on Calumet Island, county of Pontiac, Lawn mine.
IV., 10½ E. and 11, was worked last season by Messrs. Jas. and Calvin Russell, a considerable quantity of mineral was extracted and a few tons shipped to England as a sample. The mineral is found in the shape of blende containing a little galena having the following composition :

Zinc.....40 per cent.
Lead.....12 "
Silver.....15 ounces per ton of mineral.

"The work done consisted in exposing the principal and neighbouring seams. On the main vein the outcrops can be traced about 300 feet and by a shaft sunk about twelve feet, the thickness is shown to be about five feet in a north-east direction with a dip of 45° east. The ore is shipped from Clark's station, P. & P. Jct. Ry., situated six miles about from the mine, which in the other direction is three-quarters of a mile say, from Ottawa River."

The following tables illustrate the imports of zinc in all forms :

Imports of
zinc.

MISCELLANEOUS.

TABLE 8.

IMPORTS OF ZINC IN BLOCKS, PIGS AND SHEETS.

Fiscal Year.	Cwts.	Value.
1880.....	13,805	\$67,881
1881.....	20,920	94,015
1882.....	15,021	76,631
1883.....	22,765	94,799
1884.....	18,945	77,373
1885.....	20,954	70,598
1886.....	23,146	85,599
1887.....	26,142	98,557
1888.....	16,407	65,827
1889.....	19,782	83,935
1890.....	18,236	92,530
1891.....	17,984	105,023
1892.....	21,881	127,302

MISCELLANEOUS.

Imports of
zinc.

MISCELLANEOUS.

TABLE 9.

IMPORTS OF ZINC, MANUFACTURES OF.

Fiscal Year.	Value.
1880.....	\$ 8,327
1881.....	20,178
1882.....	15,526
1883.....	22,599
1884.....	11,962
1885.....	9,459
1886.....	7,345
1887.....	6,561
1888.....	7,402
1889.....	7,233
1890.....	6,472
1891.....	7,178
1892.....	7,563

MISCELLANEOUS.

TABLE 10.

IMPORTS OF SPELTER.

Fiscal Year.	Cwts.	Value.
1880.....	1,073	\$ 5,310
1881.....	2,904	12,276
1882.....	1,654	7,779
1883.....	1,274	5,196
1884.....	2,239	10,417
1885.....	3,325	10,875
1886.....	5,432	18,238
1887.....	6,908	25,007
1888.....	7,772	29,762
1889.....	8,750	37,403
1890.....	14,570	71,122
1891.....	6,249	31,459
1892.....	13,909	62,550

NATURAL GAS

NATURAL GAS.

By H. P. H. BRUMELL, F.G.S.A.,

Production.

PRODUCTION.

This industry has reached somewhat large proportions and may now be considered as having been firmly established among the important mineral industries of Canada. The sales during the year 1892 amounted to about \$150,000, all the production of Ontario as the revenue, if any, derived from the several wells in the North-west Territories was not obtained. It would not, however, very materially alter the figures given above.

DISCOVERY AND DEVELOPMENT.

NATURAL GAS
Discovery and
development.

As in previous years active operations were largely confined to Essex and Welland counties where the several large and important companies operate.

Essex County.

Essex County.

In Essex County, both the Ontario Natural Gas and Oil Company and the Kingsville Natural Gas and Oil Company sank new wells, very materially increasing their available capacity.

Kingsville Natural Gas and Oil Company.—On the 22nd December, 1891, this company brought in their No. 4 well on the C. G. Fox farm, lot 7, con. 1, Gosfield south. This boring was carried to a total depth of 1,063 feet, the surface deposits measuring 116 feet. A flow of mineral water was encountered at about 160 feet, but was cased off, the casing being carried to a depth of 531 feet. Gas was struck at 1,030 feet but drilling was continued to the total depth passing entirely through the vesicular "gas-rock" into a marly dolomite beneath. The initial flow of gas through the three-inch tubing was 2,231,000 cubic feet per day with a rock pressure of 400 pounds.

Kingsville
Natural Gas
and Oil Co.

This company during the year did a considerable amount of work in the improvement of their system of mains, etc., in Kingsville and supplied to the various houses, shops and factories about 600,000 cubic feet of gas per day.

Ontario Natural Gas and Oil Company.—This company during the year again undertook active operations, the disagreements between members of the directorate having been adjusted. Three wells in all were sunk during the year, numbered 5, 6 and 7, the older wells having been drilled under the old management. No. 5 well was sunk on the Charles Lypps farm, lot 8, con. 1, Gosfield South, and was carried to a depth of 1,045 feet, the surface deposits measuring 136 feet. Considerable difficulty was met with in this well owing to quicksands, to keep out which it was necessary to use two drive-pipes to the rock. Casing was carried to a depth of 565 feet and a small flow of gas was obtained at 950 feet at which point the well was shot. The measured daily flow of gas was only 56,700 cubic feet.

Ontario
Natural Gas
and Oil Co.

No. 6 well is situated on the Charles Wigle farm on the east half of lot 6, con. 1, Gosfield South, and was carried to a depth of 1,030 feet, of which ninety-five feet consisted of surface deposits. Casing was carried to a depth of 530 feet, effectually shutting off all water. Gas was struck at 987 feet, which, through the three-inch tubing, registered a daily flow of 6,422,000 cubic feet, with an initial rock pressure of 400 pounds.

NATURAL GAS No. 7 well is on the Solomon Wigle farm, west half of lot 6, con. 1, Gosfield South, and is 1,035 feet deep. In this gas to the extent of 1,000,000 cubic feet per day was found at 1,030 feet, at which point the well was "shot." The shooting was disastrous as salt water broke in, rendering the well comparatively useless, the gas being used only in the lighting and heating of Mr. Wigle's house. The surface deposits here measured fifty-four feet and casing was carried to a depth of 525 feet.

This company are laying mains to Leamington, *via* Ruthven, and expect to serve both these towns and vicinity.

Kent County.

Kent County.

In this county operations were carried on until the beginning of the year, when, owing to lack of success, all work ceased.

Norfolk
County.
Simcoe
Natural Gas
Co.

Norfolk County.

In this county the Simcoe Natural Gas Co. sank one well at Simcoe without success, a small flow only of gas having been met with beneath the surface deposits at a depth of ninety-eight feet. A record of the well has very kindly been forwarded by the drillers, Messrs. Carmody Bros., and is as follows :—

	Feet.	
Surface deposits.....	98	} Corniferous and Onondaga,
Hard rock.....	102	
Limestone.....	70	
Shale and gypsum.....	70	
Limestone.....	60	
Shale.....	3	
Limestone.....	42	
Shale.....	5	
Limestone.....	95	
Shale.....	5	
Limestone.....	315	} Lower Onondaga, Guelph and Niagara.
Shale.....	80	
Limestone.....	45	
Shale.....	5	} Clinton.
Red sandstone.....	20	
Shale.....	65	} Medina.
White sandstone.....	5	
Red shale.....	690	} Hudson River. Utica. Trenton.
White ".....	625	
Brown ".....	144	
Limestone.....	158	
Depth.....	2,702	

No data are at hand regarding the various features of the well, though it is understood that neither gas nor oil was found in the rocks.

Haldimand County.

NATURAL GAS
Haldimand
County.
Dunnville
Natural Gas
Co.

Although the wells in Dunnville were drilled during 1891, it has been thought advisable to note them here, as they have not been officially noticed by this Department before. Three wells in all were sunk by the Dunnville Natural Gas Co., the first one in the eastern part of the village to the north of and near the Welland Canal feeder. The following record of No. 1 well has kindly been forwarded by the drillers, Messrs. Carmody Bros. :—

	Feet.	
Surface deposits.....	76	Onondaga, Guelph and Niagara.
Limestone with gypsum	74	
Shale with gypsum.....	205	
Limestone	210	
Shale	47	Clinton.
Limestone	24	
Shale	4	
Red sandstone	45	
Shale.....	40	Medina.
White sandstone with shale.....	15	
White sandstone.....	12	
Red shale.....	20	

Depth..... 772

Sulphurous water was struck at eighty-five feet and at 500 feet a flow of saline water was noted. Casing was carried 565 feet. Gas was found at 612 feet at the summit of the Clinton limestone and again in the white sandstone at from 740 to 752 feet. The initial rock pressure was 375 pounds, and the daily flow was estimated to be about 175,000 cubic feet.

The second well was sunk on the west side of the Grand River, opposite the village, and about one mile from No. 1. In this, as may be seen from the following record, the rocks pierced were very similar to those of No. 1 :—

	Feet.	
Surface deposits.....	70	Onondaga, Guelph and Niagara.
Limestone	80	
Shale	190	
Limestone	227	
Shale	45	Clinton.
Limestone	22	
Shale	1	
Red sandstone	45	
Shale	50	Medina.
White sandstone	20	
Red shale	30	

Depth..... 780

NATURAL GAS The underground characters of the well are similar to those of No. 1, except that the rock pressure was but 335 pounds, as it was also in the third well sunk by the company. The average daily capacity of the three wells is said to be about 150,000 cubic feet each. Mains have been laid and the whole town more or less supplied for lighting and heating purposes.

Welland
County.

Welland County.

Extensive operations were carried on throughout this county, principally by the Provincial Natural Gas and Fuel Company and the Erie County Natural Gas and Fuel Company, a small amount of work having been done by the Mutual Natural Gas Company of Port Colborne.

Mutual
Natural Gas
Co.

Mutual Natural Gas Company.—The latter company have taken over the plant and useful wells of the old Port Colborne Natural Gas, Light and Fuel Company, and have drilled or bought four new wells as follows: Mutual well No. 1, lot 29, concession I., and No. 2 on lot 28 in concession II., of Humberstone, and the Hopkins wells Nos. 2 and 3 on lot 28, concession II. of Humberstone.

The Mutual well No. 1 was carried to a depth of 831 feet, at which point red shale was struck. The surface deposits measured only two feet; salt water was struck at 440 feet, and the well was cased to a depth of 573 feet. The first white gas sand was struck at 690 feet and the second at 738 feet, the combined flow from these strata being about 200,000 cubic feet per day. In No. 2 the boring was carried 708 feet and gas to the extent of 1,500,000 cubic feet per day found at 685 feet. The surface deposits measured two feet, beneath which was found 100 feet of limestone. Salt water was struck at 440 feet and was cased off, the casing being carried 635 feet. The gas rock in this well measured fifteen feet, shale being found at 700 feet. The two Hopkins wells are leased by the company and are both located on lot 28, concession I., Humberstone, No. 2 being in the village of Humberstone, near the Welland Canal, and No. 3 further to the west. No. 2 well was sunk 800 feet and gas to the amount of 400,000 cubic feet per day found at 670 feet, in the Clinton. No. 3 is sunk seventy feet north of the Mutual Company's No. 2 and afforded 1,000,000 cubic feet of gas per day. The underground characters were similar.

Provincial
and Erie
County Cos.

Provincial and Erie County Companies.—Regarding the operations of the Provincial and Erie County Companies nothing can be said beyond the fact that active drilling operations were kept up during the year throughout the territory already proved, and many improvements

made to their systems of mains, etc., both in Welland County and on NATURAL GAS. the Buffalo side of the river.

Bertie Natural Gas Company.—Although the operations of the Bertie Natural Gas Company belong to the year 1891, it has been thought advisable to mention them here, as no official notice has as yet been taken of them by this Department. On the 15th April, 1891, a well was begun a short distance to the north of the Grand Trunk Railway station at Bertie and carried to a depth of 870 feet, the record of the well being as follows :—

	Fect.	
Flinty limestone.....	60	Corniferous.
Shale and gypsum.....	90	
Shale.....	5	
"Shaly rock".....	30	
Shale and gypsum.....	15	Onondaga, Guelph and Niagara.
Shale.....	230	
Limestone.....	115	
" Siliceous.....	15	
" hard.....	110	
Shale.....	50	Clinton.
Limestone (gas).....	10	
Shale.....	10	
Red sandstone.....	70	
Sandstone.....	10	Medina.
Shale.....	20	
White sandstone.....	12	
Red shale.....	18	

Gas was found at 725 feet, at which point the boring was in the Clinton limestone, and it was again found in the Medina sandstone at 840 feet. Water was found at 100 feet and at various points up to 250 feet ; this was shut off by casing, which was carried to a depth of 660 feet.

NATURAL GAS *Welland Natural Gas Company.*—During the latter part of the year 1891 two wells were sunk for gas near the town of Welland, in neither instance successfully.

The record of No. 1 well, located on Alexander Asher's farm, has been furnished by the drillers, Messrs. Carmody Bros., and is as follows:—

	Feet.	
Surface deposits.....	110	
Shale.....	80	} Onondaga, Guelph and Niagara.
Limestone.....	225	
Shale, blue.....	65	
Limestone.....	20	} Clinton.
Shale.....	5	
Red sandstone.....	55	
Shale.....	10	} Medina.
White sandstone.....	5	
Shale.....	20	
White sandstone.....	20	
Red Shale.....	97	
Depth.....	712	

A small flow of gas was found at 300 feet, and again at 512 feet, in the Clinton limestone. Sulphurous water was met with at 220 feet, which, as well as the first gas, was shut off by casing, which reached 430 feet.

The second well was sunk on the Leitch farm, about one half-mile to the south of the above and the same distance north-east of the Welland station on the Michigan Central Railway.

The rocks pierced here were as follows:—

	Feet.	
Surface deposits.....	112	
Shale.....	118	} Onondaga, Guelph and Niagara.
Limestone.....	240	
Shale.....	50	
Limestone.....	13	} Clinton.
Red sandstone.....	45	
Shale.....	25	
White sandstone.....	20	} Medina.
Red Shale.....	82	
Depth.....	705	

The record shows an absence of shale in the lower part of the Clinton formation, and on that account is thought to be rather incorrect, as in no other instance throughout this district where the Clinton is found are the shales wanting. Other than the above

record, no data are at hand regarding this well, except that a small NATURAL GAS flow of gas of no commercial value was found.

York County.

York County.

In the vicinity of New Toronto, about ten miles west of Toronto, the New Toronto Oil and Natural Gas Company, Limited, carried on active operations, sinking several wells unsuccessfully. Their first well was sunk on the west side of Seventh street, behind McDonald's tin works. It was carried to a depth of 1,312 feet, the record being, according to Mr. L. G. Harris, the manager, as follows:—

Surface deposits	5 feet.
Shale, black.....	640 "
Limestone	595 "
Sandstone and "Arkose"	72 "

Water was struck at seventy-five and 353 feet and was cased off, the casing being carried to a depth of 364 feet. Salt water was again struck at 1,250 feet in large quantities. Small quantities only of gas were found at 780, 885 and 1,089 feet, at which points the well was shot. The combined flow from these depths was certainly not over 50,000 cubic feet per day. After several more unsuccessful attempts to find gas in quantity in the vicinity operations were discontinued.

It may not be known to all natural gas operators throughout Ontario that the Provincial Legislature passed an Act on April 14th, 1892, regarding the management of abandoned or unsuccessful wells, For the benefit of the reader, it has been thought advisable to publish it here in full:—

"AN ACT TO PREVENT THE WASTING OF NATURAL GAS.

Act to prevent waste of gas.

"Approved by the Lieutenant-Governor, April 14, 1892.

"Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:—

"1. From and after the passing of this Act any person or corporation, and each and every of them in possession, whether as owner, lessee, agent or manager, of any well in which natural gas has been found, shall, unless said gas is sooner utilized, within a reasonable time, not, however, exceeding two months from the completion of said well, in order to prevent the said gas wasting by escape, shut in and confine the same in said well until such time as it shall be utilized; provided, however, that this section shall not apply to any well while it is being operated as an oil well.

NATURAL GAS
Act to pre-
vent waste of
gas.

"2. Whenever any well shall have been put down for the purpose of drilling or exploring for gas, upon abandoning or ceasing to operate the same, the person or corporation in possession as aforesaid shall, for the purpose of excluding all water from the gas-bearing rock, and before drawing the casing, fill up the well with sand or rock sediment to a depth of at least twenty feet above the gas-bearing rock, and drive a round seasoned wooden plug, at least three feet in length, equal in diameter to the diameter of the well below the casing, to a point at least five feet below the bottom of the casing, and immediately after drawing the casing shall drive a round, seasoned wooden plug at a point just below where the lower end of the casing rested, which plug shall be at least three feet in length, tapering in form, and of the same diameter at the distance of eighteen inches from the smaller end as the diameter of the hole below the point at which it is to be driven. After the plug has been properly driven there shall be filled on top of the same sand or rock sediment to the depth of at least five feet.

"3. Any person or corporation contravening any of the provisions of the first or second sections of this Act shall be liable to a penalty not exceeding \$100 for each and every violation thereof, and to the further penalty of \$25 for each thirty days during which said violation shall continue; and all such penalties shall be recovered, with costs of suit, in a civil action or actions in the name of any person or persons who may sue for the same.

"4. Whenever any person or corporation in possession of any well in which gas has been found shall fail to comply with the provisions of the first section of this Act within the time therein set forth, any person or corporation lawfully in possession of lands on which the well is bored, or of lands situate, adjacent to or in the neighbourhood of said well, may after ten days' notice in writing to the owner of the well or his lessee, agent or manager, enter upon the lands upon which said well is situated and take possession of said well from which gas is allowed to escape or waste, in violation of said first section, and tube and pack said well and shut in said gas, and may maintain a civil action in any court of this province against the owner, lessee, agent or manager of said well, and each and every of them, jointly and severally, to recover the cost thereof, in addition to the penalties provided by section three of this Act.

"5. Whenever any person or corporation shall abandon any gas well and shall fail to comply with the second section of this Act, any person or corporation lawfully in possession of lands adjacent to or in the neighbourhood of said well may after ten day' notice in writing to the owner or his lessee, agent or manager, enter upon the land upon

which said well is situated and take possession of said well and plug the same in the manner provided by the second section of this Act, and may maintain a civil action in any court of this province against the owner or person abandoning said well, and every of them, jointly and severally, to recover the cost thereof, in addition to the penalties provided by the third section of this Act.

NATURAL GAS
Act to prevent
waste of gas.

“6. This Act shall take effect on, from and after the first day of May, 1892.”

Attention may again be called to the efforts of this department to place on record all information likely to assist in the discovery and development of natural gas and petroleum. In this much difficulty has been encountered in consequence of the indifference of drillers and others, and their failure to supply the department with a record of the facts observed in the course of their operations.

It is again earnestly urged that this office may be informed of all boring operations and that samples of the drillings be carefully kept, that accurate records of the wells may be made. For this purpose bottles or boxes will be forwarded at once on application.

Through lack of attention to the geological features of various districts many abortive attempts to find gas were made during the year. In commenting on these I cannot do better than quote part of a paragraph from the report of 1891, as follows:—

“In view of the many failures to obtain gas it cannot be too strongly impressed upon the public that there are certain definite laws governing the production and distribution of gas, and that many thousands of dollars are annually spent in futile efforts to obtain gas in ground that is known to be either barren or flooded. Gas is not to be obtained everywhere and anywhere, and before expending their capital it would be well if investors and promoters of companies would inform themselves as to the rocks and geology of the district wherein they intend operating. Of course the greater part of the advice possible for the geologist to give is necessarily of a negative character, experiment alone making absolute certainty of the productiveness of any gas territory.”

NICKEL.

Production.

NICKEL.

PRODUCTION.

The production of nickel in Canada for 1892 shows a falling off as compared with the previous year's figures of 43 per cent in quantity and 49 per cent in value.

Pounds of Nickel in Matte.

1890.....	1,435,742,	valued at \$933,232
1891.....	4,626,627	" 2,775,976
1892.....	2,413,717	" 1,399,956

The figures given above represent the quantity of nickel contained in the matte produced and shipped, together with the full value of the same at the average price for the year, for fine metal as per quotations given from time to time in the *Engineering and Mining Journal* of New York. These figures therefore represent the full value of this item of the country's mineral resources which would be realized during the year by mining operations, were the process of extraction of this useful metal completed in the country.

This, however, is not the case, the process being only carried before shipment as far as the production of a matte. The price realized for this matte is based upon its contents in nickel and copper, valued in this condition, of course, much below their final market quotation. Thus, calculating from this standpoint we get the following for the shipments of nickeliferous matte made during the year :

Nickel contents of matte, etc.,	}	2,413,717 lbs.	\$450,560
at 18 $\frac{3}{4}$ c. per lb.			
Copper contents of matte, etc.,	}	2,203,795 lbs.	130,758
at 5 $\frac{1}{4}$ c. per lb.			

Value of matte as shipped..... \$581,318

The shipments of matte as per railroad returns were 8,095,030 lbs. or 4,048 tons.

There were 564 men returned as employed in the mines and works, and 57,022 tons of ore treated.

The books of the Customs Department give the exports of "fine nickel" as below :—

5,096,332 lbs.,	valued at.....	\$242,149	to the United States.
727,150	" "	39,300	to Great Britain.
234,000	" "	11,700	to Germany.
6,057,482	" "	\$293,149	

As all the product of Canada's nickel mines is shipped abroad, there NICKEL.
is evidently some error here, probably due to the local officers entering
in some cases pounds of matte under the heading "fine nickel" in their
books. The valuation also is much too low.

DISCOVERY AND DEVELOPMENT.

Discovery and
development.

There is nothing of very great importance to report in this respect
for the year. At the nickeliferous pyrrhotite deposit near St. Stephen,
New Brunswick, which was fully described in last year's report,
nothing further has been done.

ONTARIO.

Ontario.

The mines at Sudbury have been worked during the year as for-
merly, and particulars of the characteristics of the deposits and mode
of working them and of producing matte from the ore have been fully
given in former reports.

The chief operators and only producers were the Canadian Copper
Company, working the Copper Cliff, Stobie and Evans Mines; the
Dominion Copper Company, working the Blezard and Worthington
Mines; Messrs. H. H. Vivian & Co., working the Murray Mine, and
the Drury Nickel Company, working the Chicago Nickel Mine in the
Township of Drury.

All these companies are fully equipped with plant, both for mining
and smelting their ores, and ship their product in the shape of matte,
averaging for the whole district nearly 30 per cent of nickel and about
27 per cent of copper.

At the Sheppard Mine, about a mile and a half north-east of the
Blezard Mine, on lot 1, range III., in the township of Blezard, ex-
ploratory work was prosecuted with a force of almost forty men, with
machinery, including power-drills.

A force of fifteen men worked for about three months on the Gers-
dorffite Mine for Messrs. Macdonell & O'Connor, of Sudbury, testing
the deposit found there. This is situated in the township of Drury,
on lot 12, range III., and is about a mile and a half north-east from
Worthington Station, on the Algoma Branch of the Canadian Pacific
Railway.

This constituted most of the work done in this province, with the
exception of a small amount of development done to test a nickel pro-
perty near Keewatin, in Lake of the Woods district, where some few
tons of ore were extracted, which are said to have assayed well in
nickel.

PETROLEUM.

PETROLEUM.

By H. P. H. BRUMELL, F.G.S.A.,

Statistics.

STATISTICS.

Production.—During the year, refining operations were confined to Petrolea and London in Ontario, where the following refineries were in operation :—

Imperial Oil Company, Petrolea.
 McMillan, Kittredge & Co., Petrolea.
 John McMillan, Petrolea.
 Consumers' Oil Refining Company, Petrolea.
 Petrolea Crude Oil and Tanking Company, Petrolea.
 Fairbanks, Rogers & Co., Petrolea.
 Premier Oil Company, Petrolea.
 John McDonald, Petrolea.
 Empire Oil Company, London.

From returns made direct to this office there were 27,218 gallons, or 777,680 barrels of crude oil consumed ; deducting from the 2,035 barrels decrease in stocks held by the various tanking companies, and assuming that the quantity of oil carried into and out of the year in the tanks of the refiners to be the same, there was an approximate total production of 775,645 barrels, an increase of 18,000 barrels obtained in the same way for the year previous of 18,000 barrels. At the average price for crude oil of \$1.26, the value of the year's production would be \$977,313.

As in previous years the production of crude oil, as shown in the summary table of production, is obtained by compilation from the inspection returns of the Inland Revenue Department.

The tanking companies operating as such were : The Petrolea Crude Oil and Tanking Company, The Crown Warehousing Company, and the Producers Tanking Company, all of Petrolea, and all of which kindly furnished returns of their operations during the year. The returns afford the following result :—

Stocks, 1st January, 1892.....	57,968 $\frac{1}{2}$
Quantity of oil received.....	451,638 $\frac{1}{2}$
“ “ delivered.....	453,673 $\frac{1}{2}$
Stocks, 1st January, 1893.....	55,933 $\frac{1}{2}$
Decrease in stocks during year.....	2,034 $\frac{1}{2}$

Of the operations of the refiners in the manufacture of the various products of petroleum, the following tables compiled from returns made direct to this office give the necessary information.



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PETROLEUM.

TABLE 1.

PRODUCTION OF CANADIAN OIL REFINERIES.

PETROLEUM.

Statistics.

Products.	1891.		1892.	
	Quantity.	Value.	Quantity.	Value.
Illuminating oils galls.	10,427,040	\$1,170,241	10,806,806	\$1,176,720
Benzine and naphtha "	603,971	36,790	793,263	60,130
Paraffine oils "	622,287	75,772	1,061,163	127,351
Gas and fuel oils "	3,373,720	89,267	6,343,589	202,047
Lubricating oils and tar "	2,500,000	101,752	3,177,853	133,336
Paraffine wax lbs.	741,611	60,687	876,570	82,781
Totals		\$1,534,509		\$1,782,365

PETROLEUM.

TABLE 2.

CONSUMPTION OF CRUDE OIL AND CHEMICALS.

Article.	1891.	1892.
Crude petroleum galls.	27,860,719	27,318,812
Sulphuric acid lbs.	4,213,984	4,803,301
Soda "	319,736	369,857
Litharge "	394,715	434,962
Sulphur "	54,032	73,278

The data for the compilation of the following figures and tables 3 and 4 are taken from the books of the Inland Revenue Department, and show the number of packages of Canadian oil inspected during the calendar year 1892, as well as the total quantity of refined oil, imported and domestic, inspected during the fiscal years from 1881 to 1892 inclusive.

During 1892 (calendar year) the packages of Canadian oil inspected were :

242,356 packages. at 10 cents inspection fee.

3 " at 5 " "

38,349 " at $2\frac{1}{2}$ " "

Assuming that these packages contain forty-two, ten and five gallons each respectively there will be found to have been an inspection of :

10,178,932 gallons, in packages of 42 gallons each.

30 " " 10 "

191,745 " " 5 "

$8\frac{1}{2}$

PETROLEUM. or a total inspection of 10,370,707 gallons. This quantity, computed at an average percentage of 38, would be equivalent to a consumption of crude oil of 27,291,334 gallons, or 779,753 barrels, which at the average price of \$1.26 would have a value of \$982,489.

The following table, computed in a manner similar to the foregoing, shows the quantity of crude oil used and inspected each fiscal year since 1881.

PETROLEUM.

TABLE 3.

Oils inspected. CANADIAN OILS AND NAPHTHA INSPECTED AND CORRESPONDING QUANTITIES OF CRUDE OIL.

Fiscal Year.	Refined Oils Inspected.	Crude Equivalent Calculated.	Ratio of Crude to Refined.
	Galls.	Galls.	
1881.....	6,406,783	12,813,566	100 : 50
1882.....	5,910,787	13,134,993	100 : 45
1883.....	6,970,550	15,490,111	100 : 45
1884.....	7,656,011	19,140,027	100 : 40
1885.....	7,661,617	19,154,042	100 : 40
1886.....	8,149,472	21,445,979	100 : 38
1887.....	8,243,962	21,694,637	100 : 38
1888.....	9,545,895	25,120,776	100 : 38
1889.....	9,462,834	24,902,195	100 : 38
1890.....	10,121,210	26,634,763	105 : 38
1891.....	10,270,107	27,026,597	100 : 38
1892.....	10,370,707	27,291,334	100 : 38

The following table shows the total quantity of illuminating oil, both domestic and imported, inspected during the fiscal years from 1881 to 1892, inclusive, and illustrates the market for that product in Canada.

PETROLEUM.

TABLE 4.

TOTAL AMOUNT OF OIL, IMPORTED AND CANADIAN, INSPECTED.

Fiscal Year.	Imported.	Canadian.	Total.
	Galls.	Galls.	Galls.
1881.....	476,784	6,406,783	6,883,567
1882.....	1,351,412	5,910,747	7,262,159
1883.....	1,190,828	6,970,550	8,161,378
1884.....	1,142,575	7,656,011	8,798,586
1885.....	1,278,115	7,661,617	8,939,732
1886.....	1,327,616	8,149,472	9,477,088
1887.....	1,665,604	8,243,962	9,909,566
1888.....	1,821,342	9,545,895	11,367,237
1889.....	1,767,812	9,462,834	11,230,646
1890.....	2,020,742	10,121,210	12,141,952
1891.....	2,022,002	10,270,107	12,292,109
1892.....	2,601,946	10,370,707	12,972,653

EXPORTS AND IMPORTS.

The following tables of the exports and imports of oil are compiled from information obtained from the Customs Department, and explain themselves :—

PETROLEUM.

TABLE 5.

EXPORTS OF CANADIAN CRUDE AND REFINED PETROLEUM.

Calendar Year.	Gallons.	Value.
1873.....	5,869,579	\$1,287,576
1874.....	28,946	2,509
1875.....	11,836	2,214
1876.....	2,533,772	583,550
1877.....	1,431,883	323,013
1878.....	609,171	85,571
1879.....	235,171	17,032
1880.....	3,085	751
1881.....	501	99
1882.....	1,119	286
1883.....	13,283	710
1884.....	1,098,090	30,168
1885.....	337,967	10,562
1886.....	241,716	9,855
1887.....	473,559	13,831
1888.....	196,602	74,542
1889.....	235,855	10,777
1890.....	420,492	18,154
1891.....	447,355	18,575
1892.....	311,533	13,045

PETROLEUM.

TABLE 6.

IMPORTS OF CRUDE AND REFINED PETROLEUM.

Fiscal Year.	Gallons.	Value.
1880.....	687,641	\$131,359
1881.....	1,437,475	262,168
1882.....	3,007,702	398,031
1883.....	3,086,316	358,546
1884.....	3,160,282	380,082
1885.....	3,767,441	415,195
1886.....	3,819,146	421,836
1887.....	4,290,003	467,003
1888.....	4,523,056	408,025
1889.....	4,650,274	484,462
1890.....	5,075,650	515,852
1891.....	5,071,386	498,330
1892.....	5,649,145	475,732

PETROLEUM. Subtracting the quantities of imported oil inspected (table 4) from those shown in table 6, there will be found to have been an annual importation of oil, crude and other than illuminating, as shown in the following table 7 :

PETROLEUM.**TABLE 7.****IMPORTS OF CRUDE AND MANUFACTURED OILS OTHER THAN ILLUMINATING.**

Fiscal Year.	Gallons.
1881.....	960,691
1882.....	1,656,290
1883.....	1,895,488
1884.....	2,017,707
1885.....	2,489,326
1886.....	2,491,530
1887.....	2,624,399
1888.....	2,701,714
1889.....	2,882,462
1890.....	3,054,908
1891.....	3,049,384
1892.....	3,047,199

The imports of paraffine wax and paraffine wax candles are shown in the following tables 8 and 9 :—

Paraffine wax
and candles.

PETROLEUM.**TABLE 8.****IMPORTS OF PARAFFINE WAX.**

Fiscal Year.	Pounds.	Value.
1883.....	43,716	\$ 5,166
1884.....	39,010	6,079
1885.....	59,967	8,123
1886.....	62,035	7,953
1887.....	61,132	6,796
1888.....	53,862	4,930
1889.....	63,229	5,250
1890.....	239,229	15,844
1891.....	753,854	50,275
1892.....	733,873	48,776

PETROLEUM.
TABLE 9.
IMPORTS OF PARAFFINE WAX CANDLES.

Fiscal Year.	Pounds.	Value.
1880.....	10,445	\$2,269
1881.....	7,494	1,683
1882.....	5,818	1,428
1883.....	7,149	1,734
1884.....	8,755	2,229
1885.....	9,247	2,449
1886.....	12,242	2,587
1887.....	21,364	3,611
1888.....	22,054	2,829
1889.....	8,038	1,337
1890.....	7,233	1,186
1891.....	10,598	2,116
1892.....	9,259	1,952

DISCOVERY AND DEVELOPMENT.

ONTARIO.

During the year 1892 very little was done outside of the Petrolea district where operations were carried on as in the previous year. Altogether about 2,000 new wells were sunk. Of these a number were sunk on lot 4, concession I. of Enniskillen, a part of the territory hitherto left comparatively untouched and considered of little or no value. Along the north side of the Main street in Petrolea and to the west of the main part of the town several wells were sunk, which are said to have afforded from five to fifteen barrels each per day. Altogether about 5,000 wells were producing during the year, the total production of which, computed from inspection returns, amounted to 779,753 barrels, or a little less than one half barrel each per day.

We are again indebted to Mr. James Kerr, Secretary Petroleum Exchange, for the following prices of crude oil for the year which shows a slight decrease from those of the year previous :

	1891.	1892.
January	\$1.30	\$1.20 $\frac{1}{4}$
February	1.28 $\frac{1}{2}$	1.29
March	1.31 $\frac{3}{4}$	1.27 $\frac{3}{4}$
April	1.37	1.26
May	1.37 $\frac{1}{2}$	1.25 $\frac{3}{4}$
June	1.37	1.27 $\frac{1}{2}$
July	1.33 $\frac{1}{2}$	1.26 $\frac{1}{2}$
August	1.34 $\frac{3}{4}$	1.26
September	1.35	1.26 $\frac{1}{4}$
October	1.35	1.26 $\frac{1}{4}$
November	1.33 $\frac{1}{4}$	1.25
December	1.31 $\frac{1}{2}$	1.18 $\frac{1}{2}$
Year	1.33 $\frac{1}{4}$	1.26 $\frac{1}{4}$

PETROLEUM. In Essex County Mr. Hiram Walker of Walkerville continued unsuccessfully his search for petroleum or natural gas in the vicinity of Marshfield, sinking some five or six wells and getting only small "shows" of oil in several of them. From "Walker's No. 1" they were still pumping about one barrel per day and using the oil as a lubricant on the Lake Erie and Detroit River Railway.

It is said that a small "show" of oil had been noted in the well drilled for salt at the Canadian Railway station at Windsor at a depth of 142 feet, not, however, of sufficient importance to warrant further work in its search.

Quebec.

QUEBEC.

In this province operations were carried on in the vicinity of Gaspé Basin by the Petroleum Oil Trust Company of London who completed several wells and claimed to have found oil in two of them. There have been many reports of large finds in this county, all of which have so far proved to be incorrect.

The following notes regarding operations in Gaspé are taken from a short article read by the writer before the Geological Society of America, December 30th, 1892.*

Gaspé Basin.

Operations in search of petroleum have been carried on in a desultory manner for about thirty years in the vicinity of Gaspé Basin, Gaspé county, Quebec, without as yet any economic result. The presence of oil at depth has, however, been proved through the efforts of "The Petroleum Trust," an English company, which has been operating on the south-west side of Gaspé Bay, in the neighbourhood of and to the south of Gaspé Basin.

In the eastern part of the Gaspé peninsula there is a great thickness of sandstones resting conformably upon almost as great a thickness of limestones, the whole being of Lower Devonian and possibly partly Upper Silurian age. According to Dr. R. W. Ellis,† these sandstones have a thickness of about 3,000 feet, while the underlying limestone is estimated at about 2,000 feet. These rocks are largely developed in the vicinity of Gaspé Bay, where they form a series of almost parallel anticlinals, on or near the axes of which the greater part of the exploratory work has been done.

*"Notes on the occurrence of Petroleum in Gaspé, Que.," Bull. Geol. Soc. Am., Vol. IV., p. 241.

†Report of Progress, Geol. Survey of Canada, 1880-82, p. 5 D D.

Dr. R. W. Ells, in the report cited above, speaks of these anticlinals as follows :—

“The rocks of the series have a considerable development on the several rivers that flow into Gaspé Bay, where they lie in shallow basins, bounded by the anticlinals, which bring into view the strata of the lower or Gaspé limestone series. These basins are at least four in number, the dividing anticlinals being known as the Haldimand, the Tar Point, the Point St. Peter, and the Percé, the most southerly yet recognized. On the south side they rest upon rocks of the Silurian system. The whole formation may therefore be said to occupy a general synclinal basin, the western limit of which has not yet been traced but which will probably be found to be continuous with the basin recognized on the Cascapédia River, and thence extending to the Metapédia.”

In the “Geology of Canada,” 1863, page 789, the following mention is made of the various natural oil springs of the district. This includes probably all that was known of the occurrence of oil in Gaspé up to that date :—

“At the oil spring at Silver Brook, a tributary of the York River, the petroleum oozes from a mass of sandstone and arenaceous shale which dips south-eastwardly at an angle of 13° and is nearly a mile to the south of the crown of the anticlinal. The oil, which here collects in pools along the brook, has a greenish colour and an aromatic odour which is less disagreeable than that of the petroleum of western Canada. From a boring which has been sunk in the sandstone to a depth of about 200 feet there is an abundant flow of water, accompanied with a little gas and very small quantities of oil. Farther westward, at about twelve miles from the mouth of the river, oil was observed on the surface of the water at the outcrop of the limestone. Petroleum is met with at Adam's oil spring, in the rear of lot B, York, nearly two miles east of south from the entrance of Gaspé Bay. It is here found in small quantities floating upon the surface of the water, and near by is a layer of thickened petroleum, mixed with mud, at a depth of a foot beneath the surface of the soil. A mile to the eastward, at Sandy Beach, oil is said to occur, and, again, at Haldimandtown, where it rises through the mud on the shore. These three localities are upon the sandstone and on the line of the northern anticlinal which passes a little to the north of the Silver brook spring. Farther to the south-east, on the line of the southern anticlinal and about two miles west of Tar Point, which takes its name from the petroleum found there, another oil spring is said to be found three-quarters of a mile south of Seal Cove. On the south side of

PETROLEUM.

Discovery and
development.
Gaspé Basin.

Douglastown lagoon, and about a mile west of the village, oil rises in small quantities from the mud on the beach. A well has here been bored to a depth of 125 feet in the sandstone, which dips to the south-west at an angle of 10°, but traces only of oil have been obtained. Farther to the westward oil is said to occur on the second fork of the Douglastown River. Traces of it have also been observed in a brook near Saint George's Cove, on the north-east side of Gaspé Bay. In none of these localities do the springs yield any large quantities of oil, nor have the borings which have been made in two places, been as yet successful. The above indications are, however, interesting, inasmuch as they show the existence of petroleum over a considerable area in this region, some part of which may perhaps furnish available quantities of this material."

Regarding later operations but little is known, as owing to the distance from our usual fields of work and the disinclination of operators to impart information it has been found impossible to closely follow actual operations. However, this much is known, that oil has been found at some depth, though in small quantities.

The following notes are gleaned from a report on mines and minerals of the province of Quebec recently prepared by J. Obalski, M.E., supplemented by information obtained by the writer:—

At Sandy Beach, on lot B, York township, two wells were sunk about twenty years ago, one of which is said to have afforded oil, and about a mile above Douglastown, on the southern side of the Saint John River, a well was sunk 125 feet without successful result. At Silver Brook two wells were bored to a depth of 800 and 900 feet respectively, both showing the presence of petroleum, and on the southern side of the York River, near Silver Brook, two borings were made by the Gaspé Oil Company to a depth of 700 and 800 feet, in neither of which was oil struck. Subsequent to these a well was sunk at Sandy Brook to a depth of 700 feet, in which oil was found, though in small quantity. The oil, a specimen of which was collected in 1882 by the writer, was brought to the surface of a small pool by the water, which flowed in considerable quantity from the boring, and was a heavy black oil of about 25° Baumé gravity.

In 1888 the International Oil Company of Saint Paul, Minnesota, sunk a shallow well, which was in 1889 deepened to 450 feet without finding oil. The lands and plant owned by this company were in the same year taken over by "The Petroleum Trust," which has since sunk five wells in the district. In one of these, bored at Seal Cove, a short distance south of the crown of the Tar Point anticlinal, they have met with a small quantity of high-grade oil. According to one of the

drillers, the boring reached a depth of 3,000 feet, of which the upper 2,150 consisted of yellow and white sandstone, followed by 850 feet of bluish shaly limestone, in which, at a depth of about 2,600 feet from the surface, the oil was found. The oil, which is green in colour, is of about 38° Baumé gravity, has an aromatic odour, and is bright red by transmitted light.

NORTH-WEST TERRITORIES.

It has been thought advisable to incorporate here the following extract from Mr. D. B. Dowling's summary report on his exploration during the summer of 1892. It is interesting as showing the extension eastward of the tar-sands of the Athabasca Basin:—

“The first river ascended was the Firebag, a small stream rising in a range of hills to the east of Fort McMurray, and joining the Athabasca about eighty miles below. This river in its lowest course cuts a deep valley through the lacustral deposits which form a wide belt bordering the southern shore of Lake Athabasca. Several exposures of the underlying rocks are seen; the first few are of the light coloured Devonian limestone, similar to that exposed on the Athabasca. Further up at the forks of the stream the limestone is followed by the black sandstone holding tar, but this is here represented by beds only a few feet thick, so that it probably does not extend much further to the east.

“The section of the later deposits consists of about ninety feet of stratified sand overlying beds of fine dark clay fifty feet thick. The bedding of the sand is accentuated by a liberal staining of occasional beds by tar. The surface of the country is generally undulating, the soil is principally sand with very little loam, so that it supports only scanty growth of pines. This sandy country, or sandy plain, was found to stretch all along the south side of the lake and past the Beaver river.”

The forks of the Firebag River mentioned above are about twenty-five miles above its confluence with the Athabasca.

PHOSPHATE.

PRODUCTION.

The falling off in the production of this mineral still continues, and the year 1892 shows a very considerable lessening of the figures. These are 11,932 tons, worth \$157,424, as compared with 23,500 tons, worth \$241,603, for last year, a drop in the quantity about 50 per cent, and in the total value of about 35 per cent.

PHOSPHATE. As in past years the largest production is to be credited to the Quebec district, the Ontario mines along the line of the Kingston and Pembroke Railway contributing only about one-tenth of the total.

EXPORTS AND IMPORTS.

Exports and imports.

Excepting a few hundred tons used in Canada in the manufacture of mineral fertilizers, the whole production of the mines was exported, the greater part to Europe and a smaller proportion, mostly low grade, going to the United States. Much of this latter was previously ground and dressed at the mills at Buckingham on the Canadian Pacific Railway line, twenty miles east of Ottawa. Graphic table A represents the exports of this mineral for past years, and, as the quantity used at home is small, illustrates also the fluctuations in the industry. Tables 1 and 2 need no explanation:—

PHOSPHATE.

TABLE 1.

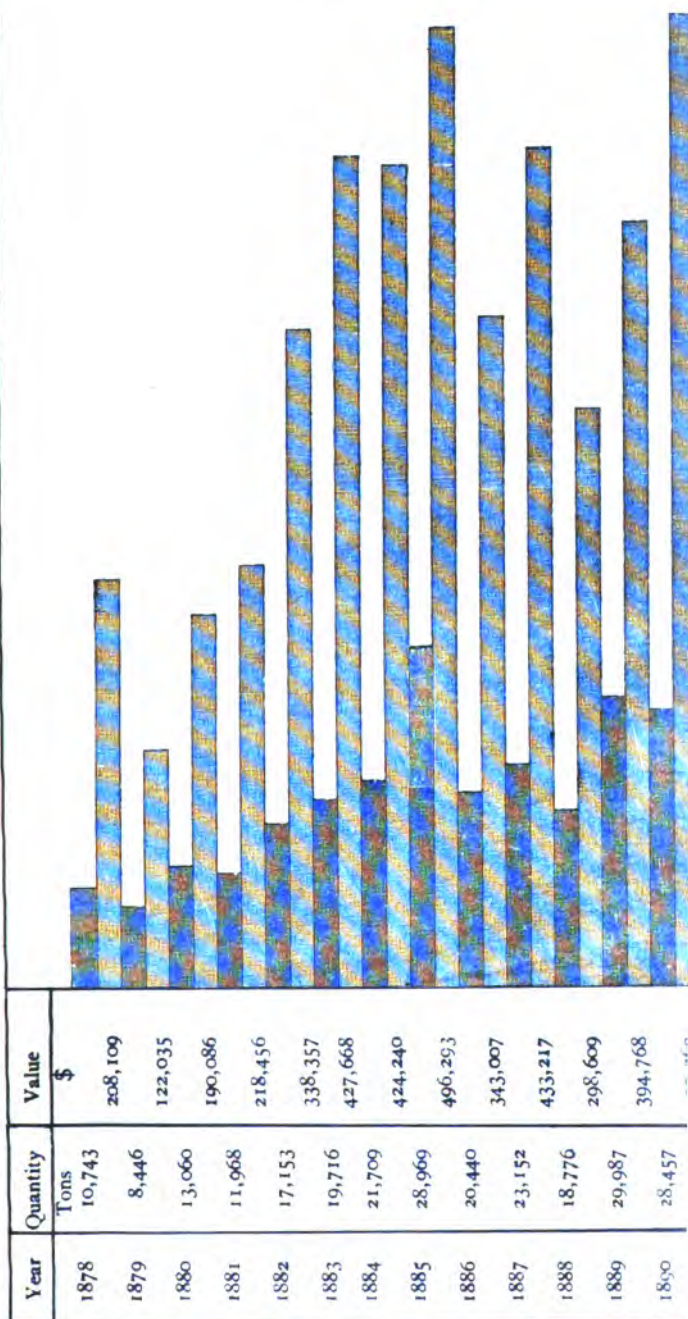
EXPORTS OF APATITE.

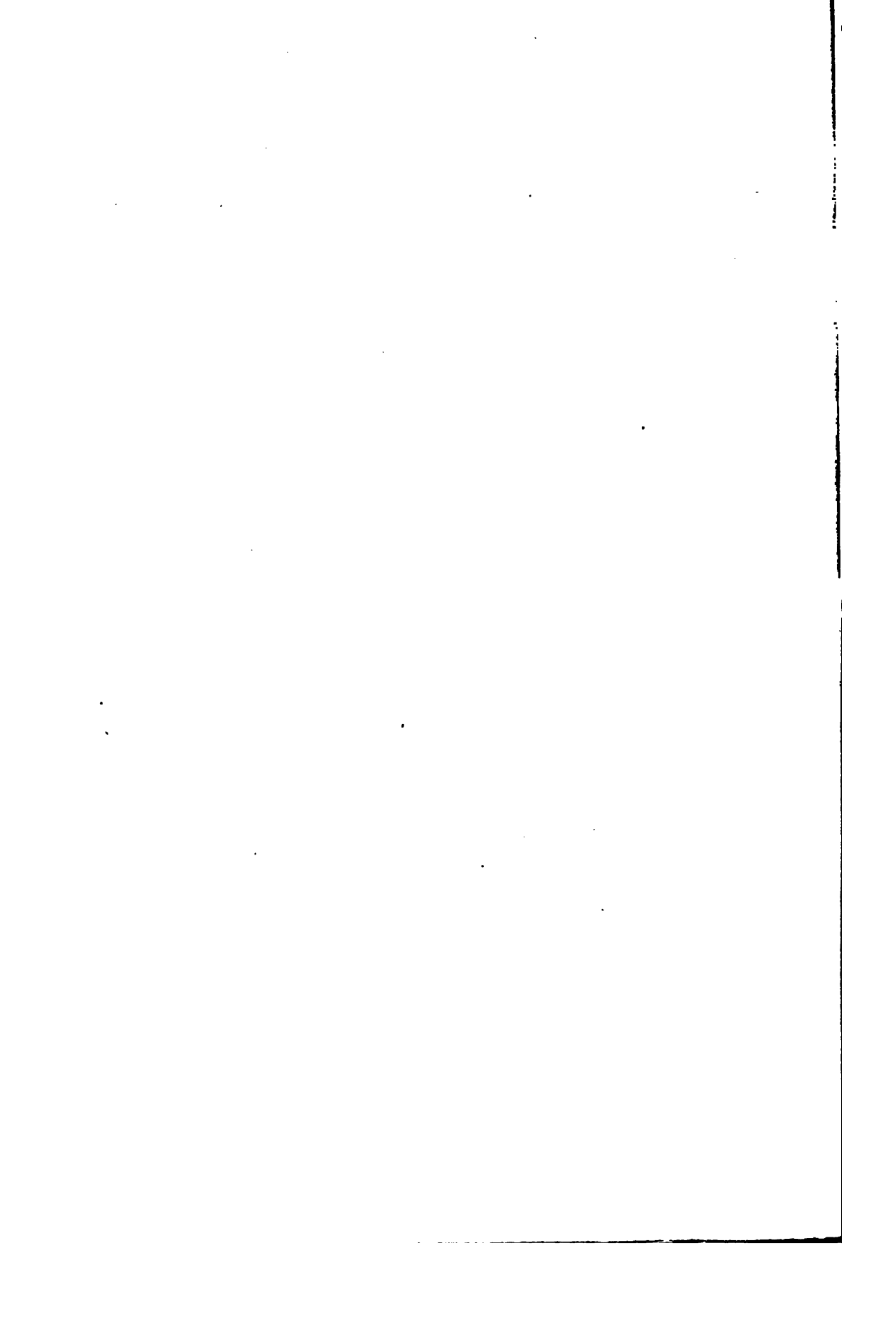
Year.	Ontario.		Quebec.	
	Tons.	Value.	Tons.	Value.
1878.....	824	\$12,278	9,919	\$195,831
1879.....	1,842	20,565	6,604	101,470
1880.....	1,387	14,422	11,673	175,664
1881.....	2,471	36,117	9,497	182,339
1882.....	568	6,338	16,585	302,019
1883.....	50	500	19,666	427,168
1884.....	763	8,890	20,946	415,350
1885.....	434	5,962	28,535	490,331
1886.....	644	5,816	19,796	337,191
1887.....	706	8,277	22,447	424,940
1888.....	2,643	30,247	16,133	268,362
1889.....	3,547	38,833	26,440	355,935
1890.....	1,866	21,329	26,591	478,040
1891.....	1,551	16,646	15,720	368,015
1892.....	1,501	12,544	9,981	141,220

PHOSPHATE

TABLE A

ANNUAL EXPORTS.





PHOSPHATE.

TABLE 2.

GREAT BRITAIN: IMPORTS OF CANADIAN APATITE COMPARED WITH TOTAL IMPORTS OF PHOSPHATES IN THAT COUNTRY.

Year.	Canadian Apatite.		Total Phosphates.		Per cent of Value of Canadian Apatite to total Value.
	Long Tons	£ stg.	Long Tons	£ stg.	
1882	8,187	39,851	199,428	613,198	6·5 per cent
1883	16,531	66,714	246,945	813,825	8·2 "
1884	15,716	52,370	219,225	643,851	8·1 "
1885	21,484	76,179	238,572	628,027	12·1 "
1886	18,069	63,490	223,111	526,885	12·0 "
1887	19,194	65,974	283,415	614,088	10·7 "
1888	12,423	42,291	257,886	544,919	7·7 "
1889	23,123	71,037	304,953	703,704	10·1 "
1890	21,089	65,420	343,501	849,452	7·8 "
1891	15,918	54,235	256,772	628,395	8·6 "

DISCOVERY AND DEVELOPMENT.

Owing to the continued depression in the market for Canadian apatite due to the competition of the phosphate mines of the southern States, no attention has been paid to exploration, and there are therefore no discoveries to report.

Several of the older mines continued working, but on a much extensive scale than formerly. Some were working principally mica, extracting the phosphate as a by-product in the process.

QUEBEC.

On the Rivière du Lièvre the chief work done was at the H. Rock mines of the Phosphate of Lime Co. and at the Ætna Squaw Hill mines of the British Phosphate Company, formerly Anglo-Continental Guano Company. These were the only two companies which worked continuously throughout the year, but the F. Falls Mine was worked in the early part of the year, and the J. Mountain, Central Lake, Ruby and others worked small gangs of for short periods during the year.

PHOSPHATE.

Discovery and
development.
Quebec.

The completion of the dam and lock at Little Rapids, about twelve miles above Buckingham, have greatly facilitated the navigation of the river and will make it easier and safer to transport the mineral in scows from the mines above that point. The resultant raising of the water level has added two miles of navigable water where the Long Rapids used to be above High Rock Landing, thus facilitating the shipments from the vicinity of High Falls and giving a navigable stretch of over twenty miles above Buckingham village, where transshipment is made to the Canadian Pacific Railway system.

In the Templeton district a little work was done at some of the older mines.

Ontario.**ONTARIO.**

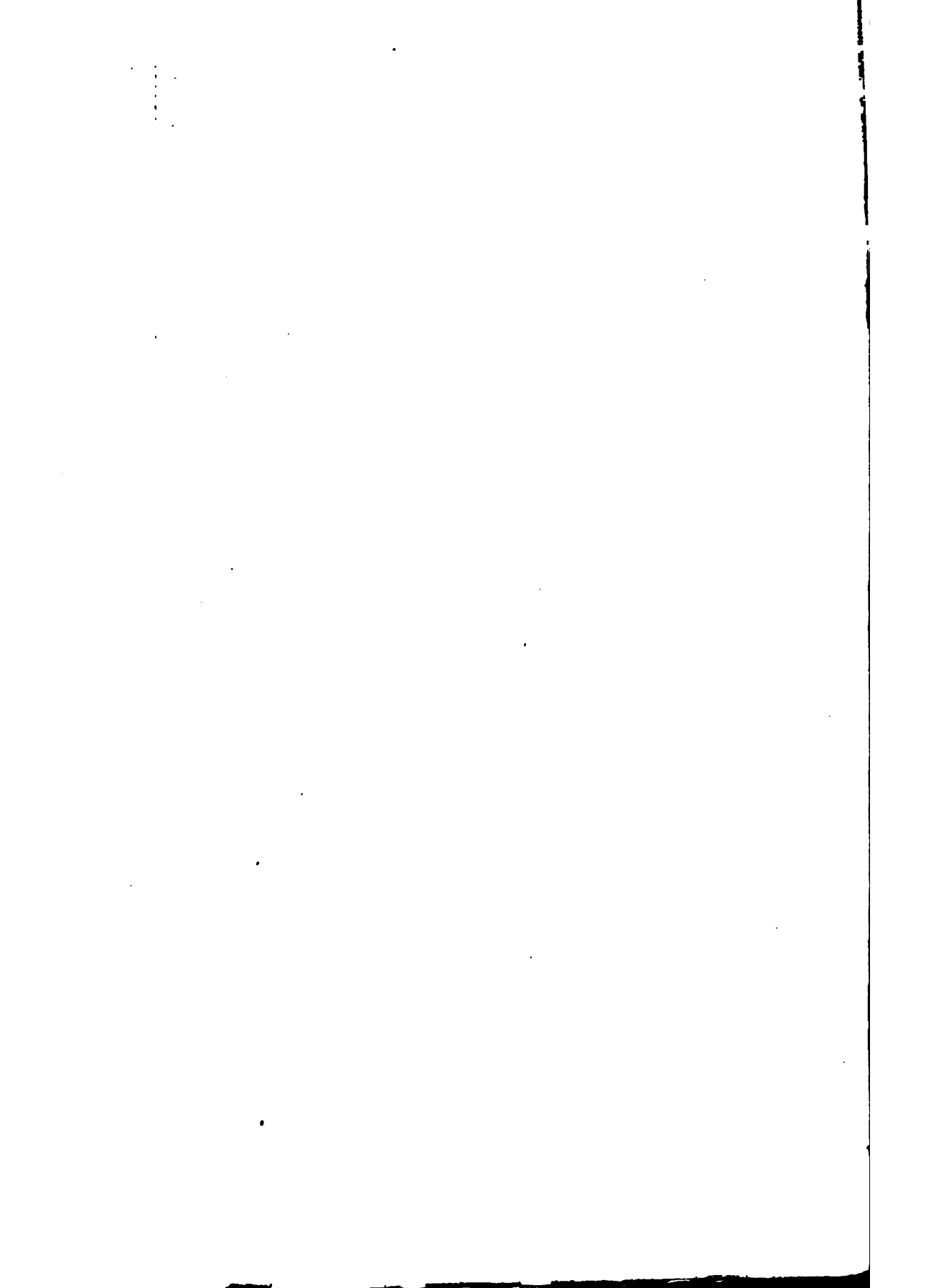
For this province there is little to report. Some of the mines were worked in a small way, but the depression in the phosphate mining industry was felt perhaps even more there than in the Quebec districts.

**PRECIOUS
METALS.****THE PRECIOUS METALS.****Gold.****GOLD.****Production.****PRODUCTION.**

The production of this metal during 1892 amounted to 50,350 oz valued at \$907,601. For last year the figures were 51,303 oz valued at \$930,614, so that there has been a falling off of about two per cent. By reference to table No. 1 below it is seen that Nova Scotia and British Columbia show a considerable falling off, which is partly made up by the increased production of Quebec, Ontario and the North-west Territories and Yukon district.

Nova Scotia from its quartz mining and British Columbia from the working of its alluvial deposits still continue to yield almost the whole amount produced, the other districts contributing under fifteen per cent of the total.

As in former years, the output of Quebec resulted from washing the auriferous gravels of the Chaudière district in Beauce County; that from the North West Territories, etc., from washing on the Saskatchewan and Yukon rivers, and that from Ontario from quartz mining.



GOLD.

TABLE 1.

PRODUCTION BY PROVINCES.

Provinces.	Ounces.	Value.
Nova Scotia	19,998	\$389,965
Quebec	721	12,987
Ontario	365	7,118
North-west Territories (including Yukon District).....	5,765	98,006
British Columbia.....	23,501	399,525
Total.....	50,350	\$907,601

BRITISH COLUMBIA.

The accompanying graphic tables A, B and C show in diagram form the details of the production for this province. They are piled from the report of the Provincial Department of Mines.

The banks of the province exported the following amount of gold during the year, viz., \$332,938. By adding to this one-fifth of the estimated amount taken out of the country in private hands, viz., the total amount of gold produced and sold.

Table 2 below is self-explanatory.

PRECIOUS
METALS.

GOLD.

TABLE 2.

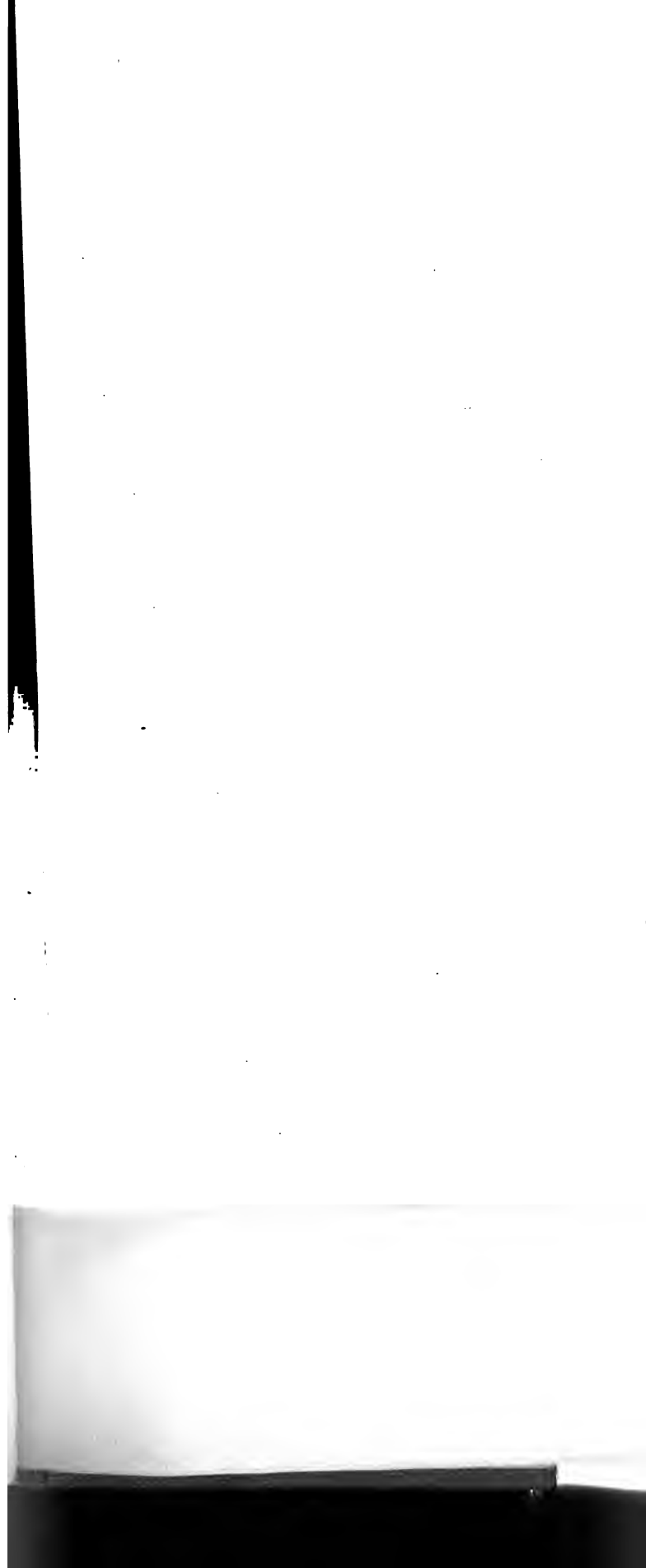
YIELD, ETC., BY DISTRICTS.

District.	Divisions.	Whites.	Chinese.	Yield of gold by divisions.	Total yield by divisions.
Cariboo	Barkerville	84	145	\$76,600	\$194,020
	Lightning Creek	30	113	41,500	
	Quesnelle Mouth	3	106	23,500	
	Keithley Creek	57	225	52,420	
		174	589		
Cassiar	Laketown	16	32	15,200	28,950
	McDaine Creek	6	22	9,200	
	Liard River			3,600	
	Stikine	9	3	950	
		31	57		
Kootenay	Eastern	24	73	29,700	39,700
	Western			10,000	
		24	73		
Lillooet		25	60	39,763	39,763
Yale	Osoyoos	160	21	9,600	31,100
	Similkameen	53	73	21,500	
		213	94		
	Total, Whites	467			
	" Chinese		873		
	" employed	1,340			\$333,533

Nova Scotia. NOVA SCOTIA.

The accompanying tables, graphic, D, E, and Nos. 3 and 4, are compiled from data obtained through the Department of Mines of Nova Scotia.

Table No. 4 on comparison with the similar statement for 1891 shows a falling off in every particular:



**PRECIOUS
METALS.**

Nova Scotia.

GOLD.

TABLE 3.

NOVA SCOTIA.

PRODUCTION OF THE DIFFERENT DISTRICTS FROM 1862 TO 1891, INCLUSIVE.

Districts.	Tons Crushed.	Total Yield.		Average per
		Oz. Dwt. Grs.	Value.	
Caribou & Moose River	56,949	27,877 13 20	\$ 543,615	\$
Montague	18,771	36,144 2 16	704,810	
Oldham	42,425	47,245 9 18	921,287	
Renfrew	46,071	31,814 13 2	620,385	
Sherbrooke	167,188	119,946 17 22	2,338,964	
Stormont	26,749	26,748 17 11	521,603	
Tangier	29,803	19,301 16 6	376,386	
Uniaske	39,993	27,196 2 22	530,324	
Waverly	97,846	55,382 14 14	1,079,963	
Salmon River	44,005	13,163 14 0	266,693	
Brookfield	5,663	4,858 4 9	94,735	
Whiteburn	5,875	9,281 2 20	180,982	
Lake Catcha	8,926	8,477 17 19	165,318	
Rawdon	11,389	9,060 14 4	176,684	
Wine Harbour	41,798	28,639 6 1	553,467	
Darr's Hill	39,909	18,715 19 19	364,962	
Fifteen Mile Stream	15,775	8,783 19 5	171,288	
Malaga	18,567	15,343 10 8	299,199	
Unproclaimed, etc.	54,357	41,717 15 13	813,497	
Totals	772,059	549,700 12 13	\$10,719,162	\$

GOLD.

TABLE 4.

DISTRICT DETAILS.

District.	No. of Mines.	Days Labour.	Mills.	Tons Crushed.	Yield of Gold per Ton.		Total Yield Gold	
					Oz. Dwt. Grs.		Oz. Dwt.	
Tangier	2	3,172	2	311	6 15		103 8	
Mooseland	2	17,032	2	2,259	1 7 9		3,093 13	
Oldham	4	14,309	4	7,189	6 11		2,335 16	
Caribou	2	18,094	1	3,625	13 18		2,482 11	
Moose River	1	11,702	1	4,220	4 22		1,042 10	
Stormont	3	4,470	2	893	4		179 8	
Salmon River	1	6,640	1	1,716	1 5 15		2,201 10	
Sherbrooke	2	7,772	2	2,720	19 12		2,656 5	
Montague	2	9,057	1	3,154	5 17		906 11	
Malaga	3	12,006	2	786	2 18 12		2,300 0	
Waverly	2	5,284	2	2,467	8 11		1,046 18	
Uniaske	2	7,825	1	2,412	12 13		1,236 17	
Lake Catcha	4	3,398	3	800	10 7		412 13	
Fifteen Mile Stream								
Unproclaimed and other districts.								
Total	30	120,761	24	32,552	12 7		19,998 8	

PRECIOUS
METALS.

Since completion of table, additional returns from Waverly s 1,051 tons of quartz crushed, and 332 oz. of gold for November December, and returns from Truro Mill, Caribou, show 30 tons yield 750 oz. for the month of December.

Quebec.

QUEBEC.

Production.

The greater activity in the Chaudière district of Quebec resulted in a very encouraging increase, the production of metal being over seven times as great as the annual output for several years back. Graphic table F clearly illustrates this point.

North-west
Territories.

NORTH-WEST TERRITORIES, ETC.

Production.

The production of gold credited to the North-west Territories and the Yukon district is over twice that of last year. These figures apt to vary much year by year, as the variations in the season with regard to water supply affect the river and placer washings very considerably and cause great fluctuations in the success of the operations.

Table 5 below shows the exports of gold as compiled from reports of the Customs Department.

Gold, exports.

GOLD.

TABLE 5.

EXPORTS.

Provinces.	1887.	1888.	1889.	1890.	1891.	1892.
Ontario.....	\$6,650	.....	\$2,660	.....	\$1,000	\$1,525
Nova Scotia. . .	321,379	\$163,412	191,671	\$304,521	.....	.....
Manitoba.....	.....	50	261	.....	110	.....
B. Columbia...	592,300	464,696	414,658	402,271	343,582	276,300
Totals ...	\$920,329	\$628,158	\$609,250	\$706,792	\$344,692	\$277,825

Silver.

SILVER.

Production.

The production of this metal for 1892 shows a decrease in the quantity of 103,872 oz. and in the value of \$136,744. The decrease in the quantity of the total production is due to the considerable limitation of the operations of the silver mines of the Thunder Bay district

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of Ontario, which more than offsets the increased output from the new argentiferous galena districts of West Kootenay and British Columbia. For the year the drop in value has been greater than the decrease in quantity, a fact due to the average market price, viz., 86 cts. per ounce as compared with for 1891.

By reference to table 1 below it will be seen that the greater amount was contributed to by Ontario, Quebec and British Columbia. The amounts credited to Ontario resulted from the working of the mines in the Thunder Bay district, south-west of Port Arthur. In former years the Quebec output represents the calculated amount of silver contained in the shipments of pyritous copper ores from the Capelton group of mines in the Eastern Townships. The British Columbia figures represent the silver contents of argentiferous galena shipped from the various claims in the Kaslo-Slocan and Ainsworth districts of the West Kootenay division of the province.

SILVER.

TABLE 1.

PRODUCTION OF SILVER.

YEAR.	ONTARIO.		QUEBEC.		BRITISH COLUMBIA.		TOTAL.
	Oz.	Value.	Oz.	Value.	Oz.	Value.	
1887.....	190,495	\$190,495	146,898	\$146,898	11,937	\$11,937	349,330
1888.....	208,064	208,064	149,388	149,388	37,925	37,925	395,377
1889.....	181,609	162,309	148,517	133,666	53,192	47,873	383,318
1890.....	158,715	166,652	171,545	180,122	70,427	73,948	400,687
1891.....	225,633	221,120	185,584	181,872	3,306	3,241	414,523
1892.....	41,581	36,072	191,910	166,482	77,160	66,935	310,651

The accompanying graphic table G shows the fluctuations during the year, bringing out clearly the great drop in the price of this metal.

PRECIOUS
METALS.
Silver,
exports.

Table 2 below gives the exports of ore of this metal as compiled from data obtained from the books of the Customs Department.

SILVER.

TABLE 2.

EXPORTS OF SILVER ORE.

Province.	1886.	1887.	1888.	1889.	1890.	1891.	1892.
Ontario.	\$16,505	\$184,763	\$208,064	\$203,871	\$203,142	\$222,071	\$35,992
Quebec	8,000	450	5	2,500	900	.....	.....
Nova Scotia.....	.....	.....	.....	50	.....	.....	.....
Manitoba.....	1,452	3,741	.....	5	.....	.....	80
British Columbia. .	.....	17,331	10,939	5,737	100	3,241	20,616
Totals ..	\$25,957	\$206,285	\$219,008	\$212,163	\$204,142	\$225,312	\$56,688

Discovery and
development.

DISCOVERY AND DEVELOPMENT.

GOLD AND SILVER.

The progress of discovery and development of deposits of the precious metals are considered together below.

Gold.

Gold.

Nova Scotia. NOVA SCOTIA.

The mines of Nova Scotia have been worked during the year as in the past upon quartz veins of the province. The report of the Department of Mines of the Provincial Government gives the following details which are here reproduced with some slight alterations to ensure uniformity with the rest of this report.

Deputy Inspector Maddin gives the following notes on the results of his visits to some of the gold districts during 1892 :—

"*Crow's Nest Mine.*—At date of my visit, 30th August, this mine was idle ; the manager, Mr. Duncan Rankin, was on the ground and courteously showed me over the work. He has opened up some new leads which look very well. His ideas, which appear perfectly plain and practicable, would I think if acted upon and carried out, be efficient and considerable saving to the company.

"*Cochrane Hill Mine.*—I was at the mine on the 30th August, and found three men prospecting, and had opened up a new lead which showed gold.

"*Country Harbour Gold Mines.*—31st August. The Copeland is down 100 feet. They have a fifteen stamp mill and employ men. This is a new mine and looks very well. Manager, J. Donald ; underground manager, J. C. Mason.

"*Johnston Mine.*—Manager, R. McNaughton. It was idle of visit.

"*Isaac's Harbour.*—No. 9, South Mulgrave, has not been since my last report.

"*The Modoc Lind.*—Wm. Hughes and others worked this to the 25th August. It is now idle.

"*The North Star Co.*—Manager, Robert McLeod ; underground manager, W. Walsh. Were down, at date of visit, 400 feet angle of from 20° to 30° south. There is also a westerly dip by a roll in the measures. Thirty men are employed. A new nearly completed with ten stamps, also a new engine and boiler is of sufficient strength to run the mill and two or three hoists. This mine is in good working order. There is another mine in this district called the Richardson mine. Manager, Anderson ; underground manager, C. Silver. Thirty-one employed. They are erecting buildings and sinking on the various and intend erecting a twenty stamp mill.

"*Wine Harbour.*—September 1st. E. Conroy, underground manager, has sixteen men under him opening up the old plan lead manager, H. Harding, was absent at the time of my visit.

"*Goldenville.*—September 2nd. There is a new property opened up here called the 'Alexander.' About ten men employed the time of my visit.

"John Williams is opening up the old Wellington mine. Sixteen men employed, and was engaged taking out the water by means of a syphon.

"*Ecum Secum Mine.*—September 3rd. Mathew McGrath, manager ; thirteen men employed, they are working on the south dip have an eight stamp mill. Since Mr. McGrath took charge this is paying.

"I went in that district to Moose Head, to see a mine which has been idle for the past three or four years ; there is a twelve stamp mill, and engine and boiler, all looking fairly well.

"*Hurricane Cove.*—There is an eight stamp mill, with engine and boiler, this property looks very well. I was informed that one Mann was going to start work here in a very short time. The two mentioned mines are parallel cases almost to the Crow's

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mine and Cochran Hill mine, referred to before, and I cannot but say here, it looks very odd to see mining properties well equipped with all necessary plant and very little work done, property not half prospected, and the plant and buildings left to rust and decay.

"Dufferin Mine.—Salmon river, September 5th. Manager, H. Archibald; underground manager, R. S. Irving. This mine is working in the second east shaft which is now down to a depth of 200 feet; the other is down 300 feet; they are cross-cutting north. They have a 16-foot belt showing gold, also an 8-inch lead, which in test yielded one ounce to the ton. There are forty men employed. All the milling is done by water power, also the hoisting. They have a twenty stamp mill, which is capable of crushing sixty tons in 24 hours. This is a fine mine in every respect.

"Tangier.—September 6. Mining operations have in this place been virtually at a stand-still for some years past, but the operators have at last been rewarded by striking what some think to be a good paying lead.

"Oxford Gold Mining Company, Chezzetcook.—Manager, J. M. Reade; underground manager, D. M. Thompson. As stated in last year's report, this mine is worked economically; compressed air being used for pumping, drilling, hoisting, etc., etc. They have a ten stamp mill, and 22 men are employed. A large quantity of surface has been milled, and paid very well; but advantage was taken during the dry season to prospect, and some leads were opened up further west; these leads are giving them all the crushing they want, and the surface remains for slack time. This mine is doing very well; they are now working in what is called the Randolph lead and the Barker lead.

"In the same district John H. Anderson employed twelve men working in the Lake lead and the Baker lead, and one Wm. Carl has three men employed working on the Cogswell or Angler lead.

"This appears to be a very fine looking mining district, and both men and management appear satisfied, a pretty safe indication that prosperity attends their work.

"I might say that the mines I visited were in good order for the workmen, and for ventilation, and for timbering, and loaders are much better pleased, and I think I am safe in saying that gold mining is somewhat ahead of last year. The roads are 50 per cent better around the mines than they were last year, which will undoubtedly prove a help to both miners and prospectors.

"Mooseland District.—October 3rd. Visited Gay's river, and found William Todd, with seven men prospecting, and Frank Burnos,

with six men prospecting, and Thomas Bogo, with six or eight taking water out of an old shaft for some Truro company.

"October 4th. Visited Moose river gold mines, M. D. T. manager, and Thomas, underground manager. Twenty men employed on the little North lead, and the Copper lead; this in good condition and they appear to be getting a fair share they have been and are crushing a large amount of surface well.

"William Bruce has eight men at work in the Archibald property and is doing fairly well. This district is much the same as last but the roads are much better.

"October 5. Visited Mooseland and found G. Stemshaw, manager, and E. Magrath, underground manager. Eighteen men employ an eight stamp mill. A very large amount of prospecting has been done on this property previous to sinking the present shaft, and they are now receiving a reward for their labour and perseverance. The shaft is sunk in a basin, and the river runs only 120 feet away from the shaft. It is, however, the driest shaft I have yet seen in the gold mines. A large water tank was placed about 20 feet above the shaft, and all the water from surface is caught in, thus leaving the mine where the miners are working comparatively dry, which is considered to be a great saving to machinery, beside the comfort of the men, and the men can do more work than if the water was allowed to go down into the mine.

"There are two men, Gladwin and Hare, working in the McIntosh property, and have six men employed. The work is in good order.

"*Caribou Gold Mines.*—October 6, I visited this district. Manager, H. Dickson; underground manager, Patrick Coffie. Twenty men are employed working on the old Fisher lead. This mine is in good condition and appears to be doing very well. There is nothing worthy of notice since my last return, but it is very probable that Dickson will do some prospecting shortly.

"George Stewart is beginning to develop the Lake lead again, showing some very fine metal. He has seven or eight men employed and intends to gradually increase his force.

"R. Wright is prospecting north of the Lake lead and has four men employed. Gold mining appears to be more vigorously and abundantly prosecuted this year than last.

"*Oldham District.*—The Standard Gold Company, working the Dunbrack Lode, have attained a depth of 490 feet. The mine is equipped with steam winding and pumping engines, and an a

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drifts on the Baker vein, at a depth of 360 feet, and have also done considerable stoping work on the Dunbrack lode. The new mill of this company does all the crushing for the district, and has run steadily during the year. The Napier Mining Company, Limited, have sunk a vertical shaft to the depth of 113 feet on the crown of the anticlinal on area No. 102. This shaft has cut seven new lodes, saddling over the anticlinal axis, and which never cropped to the surface. At a depth of 100 feet, crosscuts have been carried over 100 feet each way, and from these levels have been started on the several veins cut.

"These three companies are under the management of J. E. Hardman, with Wm. MacKintosh, foreman, and produced 2,944 ounces, during 1892.

"The following report of Mr. G. W. Stuart is of interest as showing the success of a short campaign in gold mining in the Caribou district :—

To T. G. McMULLIN, Esq.,

President Truro Gold Mining Company.

"The following is my report of operations at your mine for quarter ending December 31st, 1892, and suggestions for future operations. The former, I trust, will be satisfactory to you, and the latter meet with your approval :—

"The tribute lease was purchased and the mine formally taken over on the first day of October. I found the entire plant, machinery in particular, in very bad order, and the most of it inadequate for the work required. To ascertain the prospective value of your mine, I determined to struggle through a month without much extraordinary expense, which I succeeded in doing with much difficulty from numerous breakdowns. I succeeded in getting $246\frac{1}{2}$ days' work underground, and raising twenty-two tons of quartz, which yielded $272\frac{1}{2}$ ounces of gold. This result warranted my conclusion to reconstruct your entire surface plant, for which I made as rapid preparations as possible, continuing mining operations in rather a desultory manner until the 17th of November, when I shut down.

"After removing the old machinery I set, by plans furnished me by J. E. Hardman, S. B., a 40 h. p. tubular boiler; a new 30 h. p. engine on eight feet of solid masonry; built a new amalgamating room, and reconstructed all amalgamating appliances; put in a new friction hoist pulley; erected a new smithy; built a new shaft house and manager's office building, and other various changes and improvements.

On the 7th of December the new engine and pumps were in
On the 14th, the mine was again unwatered and mining resumed
the 30th, after running 140 hours with five stamps, I cleaned
smelted 750 ounces of gold from thirty tons of quartz, mine
November 1st until 17th, and from December 14th until 30th, 1
nine working days of sixteen men under ground, representing
days' labour.

“‘I must tell you the chief part of this gold came from the
strike cut at a depth of 75 feet, in your east shaft, which is 180
on the lode from your mill shaft, which is now 115 feet deep
strike is dipping west toward the mill shaft, at an angle of 4
lode below the strike is poor, as far as we have proved it. To
sinking the east shaft and stoping below the strike, which you
readily understand would require to be done in order to follow
be a waste of money. When by sinking the main shaft 136 f
low its present depth, the strike will be cut, when you will have
220 feet of it to work upon, the advantage of which I need no
tion. I therefore propose to cease work on the strike in the
shaft, and push down the mill shafts. The mill shaft stopes in
the quartz has lately materially improved. This course I shall
unless otherwise directed by your board.

“‘The early extraordinary severity of the winter, prevented
from erecting a shaft house, and putting in a pump in the open
the lode, 200 feet west of the mill shaft, where the lode is large
shows much stronger indications of great richness, than it shows
your east shaft above the rich strike we have in it. Immediately
spring opens I propose putting this shaft in operation.

“‘I have contracted for 1,200 cords of hardwood, at \$1.50 per
and have already delivered at the works over 300 of this.

“‘I herewith hand you all the vouchers, receipts, etc., of ex-
tures and bank returns for gold, all of which I trust you will
correct.

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“ ‘Net mint returns after deducting mint and bank charges :—

Discovery and development.	1892, Nov. 7th, Gold bar, 272.50 ounces.....	\$ 5,075.05
Gold.	1893, Jan. 7th do 739.85 do	13,907.01
Nova Scotia.	1,022.35 ounces.	\$18,982.06
	Total cost of gold production.....	\$1,935.50
	Stock in hand, viz. :—	
	Wood, tools, oils, lumber, etc.....	697.82
	Expense of new buildings, machinery and construction.....	2,125.00
		4,758.32
		\$14,223.74
	Add wood, etc., on hand as above.....	\$ 697.82
	New buildings, etc., as above.....	2,125.00
		2,822.82
	Profit since Oct. 1st, 1892.....	\$17,046.56

“ ‘All of which is respectfully submitted.

“ ‘Your faithfully,

“ ‘G. W. STUART,

“ ‘Manager Truro Gold Mining Co.

“ ‘Caribou, January 10th, 1893.’ ”

Faribault on
mode of
occurrence.

Mr. Faribault of the Geological Survey staff has made some further interesting observations on the mode of occurrence of the gold veins of Nova Scotia, of which he gives the following data : *

“The district surveyed lies westward of that surveyed in 1891 and extends on the north-west side of the Intercolonial railway, from the Nine Mile river to Bedford and as far as the Gore, Central Rawdon, Newport, Mount Uniacke, Lake Pockwock and Hammond's plains ; covering an area of 190 square miles in Hants county, and 160 square miles in Halifax county. Besides this, Mr. Laberge surveyed with the odometer 180 miles of roads in Halifax county and thirty-five miles in Lunenburg county, to be used as tie-lines in next year's contemplated work.

“The region examined is occupied entirely by the auriferous Lower Cambrian rocks which are the extension to the south and south-east of the rocks described last year ; while on the north they are unconfor-

* Summary Report of the Geological Survey for 1892, p. 37.

mably overlaid by the Lower Carboniferous studied by Mr. H. Fle and on the west come against the most eastern spur of a great m granite and granitoid rock, supposed to extend uninterruptedly western part of the province.

"The various east and west plications of these rocks, and especially their anticlinal axes were minutely examined and traced in former years, on account of their close relation to the auriferous belts. Those of Waverley, Oldham and Carroll's Corner, trace year to the Beaver Bank road, were followed westward. The crosses the Windsor road half a mile north of its junction with the Cobequid road, the old Hammond's plains road at the south end of Sandy Lake, and Karney's road at the head of Karney's lake, before which it strikes the granite mass. Many quartz veins have been suspected to a small extent along this line, particularly in the vicinity of Karney's lake, where veins showing a little gold have been opened.

"Some five miles and a half further north is the anticlinal fold of the Oldham gold district, which flattens out and disappears three miles east of the mine; while to the westward its axis dips westerly so that at the railway bridge on the inlet of Grand lake, the lower auriferous quartzites are entirely covered by the upper granitic slates. The latter form here a belt nearly three miles wide, crossing the Windsor road between the Upper Sackville post office and the fork of the roads, one mile south of Middle Sackville post office, and striking the granite mass at Hammond's plains. Good paving stones and a little roofing slate were quarried in this belt at Beaver Lake station, where the stratification is horizontal and the cleavage perpendicular to it, making the splitting very easy. Outside the district of Oldham this anticlinal is apparently of no economic importance.

"Two miles north of it is Carroll's Corner anticlinal. It crosses Key's Brook half a mile above the road, where some exploratory work on two or three auriferous leads was done a few years ago, and runs westward crosses the Shubenacadie river, along which it is concealed by a narrow basin of Lower Carboniferous rocks, passes about Enfield station, strikes the outlet of Grand lake and its north-western shore at the mouth of Rocky brook, crosses Sandy lake, the north end of Square lake and the Windsor road at Lewis lake and ends at the mass of granite on Pockwock lake. That no prospecting has been done along this anticlinal west of Key's brook is probably due to it being in great part covered by forest and thick soil, but no doubt systematic exploratory work would reveal auriferous veins, especially between Grand lake and Lewis lake.

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"The next folds further north are covered over at their eastern extremities by the Lower Carboniferous basin of the Shubenacadie river and have not been met with to the eastward. It is very probable, however, that the first anticlinal passing through South Uniacke gold district and the black slate belt north of it are the prolongation of the folds already traced immediately south of the Lower Carboniferous basin of the Upper Stewiacke river. The South Uniacke anticlinal, unlike any other fold, has flat dips on its south side for a distance of over a quarter of a mile, while its north side is perpendicular. The rich "Hard lead," worked by Mr. Thompson in this district, lies as much as 900 feet north from the apex of the fold. But it is important to notice here that this lead, like most of the richest leads worked in the province, is situated at the limit of the curvature of the denuded fold, or in other words where the dip of the fold, after having gradually increased from 0° at the apex to an angle varying from 45° to 90° , becomes uniform, and does not change for a certain distance. It is, to a certain degree, for the same reason that in sharp anticlinal folds the richest leads are situated near the apex, as at the districts of Salmon river, Fifteen Mile stream, Killag, Caribou, Mooseland and the west end of Oldham; while in broad anticlinal folds, like those of Renfrew and the east end of Oldham, the richest leads are generally at a considerable distance from the apex. The anticlinal appears to extend only a short distance east of the gold district of South Uniacke, but to the westward a great many quartz leads might be prospected with advantage as far as the Windsor road which it crosses a quarter of a mile north of the county line to come against the granite west of Lacy Mill lake.

"The black slate belt, in the synclinal trough between this anticlinal and the next, is one mile and three-quarters wide where it crosses the Renfrew road about the north end of Grand lake, but further west, at the Eller settlement on the Windsor road, a small anticlinal fold brings up a band of lower 'whin' rocks one mile wide, thus dividing the slate belt into two bands, the south one three-quarters of a mile wide extending but a short distance further west to the granite mass on West lake, while the north band, only a few hundred feet wide, disappears and is replaced by 'whin' before reaching the granite mass.

"North of the slate belt is the Mount Uniacke anticlinal fold. Its eastern end has the form of a broad elliptical dome, on the south side of which are situated the Renfrew gold mines operated for many years, but very little worked at present. Running westward, this anticlinal passes south of McGrath lake, and west of Beaver Bank road it

appears to have been disturbed by a fault with a thrust of a n so to the south on the west side. Resuming its course westwa has all the leads of the gold district of Mount Uniacke, once so e sively worked, on its south dips, and crosses the Windsor road i middle of the large bog, half way between Mount Uniacke statio Lakeland, beyond which it comes in contact with the granite. anticlinal, the most important in the region surveyed and the above mentioned require further examination. Suffice it to say a sent that systematic explorations in the last two mentioned gold tricts would certainly bring to light a great many new auriferous and that many leads worked to small depths and abandoned i earlier days of the districts could now be worked with profit b improved and more economical methods of mining of the last years.

"The auriferous quartz veins worked to some extent a few year at East Rawdon are apparently on a small local fold of the l 'whin' rocks near the southern edge of the Rawdon slate belt require further examination.

"Some three miles and three-quarters north of the Mount Uni anticlinal is the broad and well-known slate belt of Rawdon I. The eastern point of this belt extends as far as the Bar settle where it is covered by the Lower Carboniferous. At Upper Rawd has a width of five miles and a half, on the Beaver Bank road, bet George Wallace's and the Gore; at Central Rawdon, of four r between South Rawdon post office and Woodville; it extends w short distance beyond Upper Newport and Ardoise hill, where covered by Lower Carboniferous gypsum and limestone. These r are lithologically the same as those of the upper graphitic slate g of the Lower Cambrian, like them they rest conformably, along t southern limits, on the lower quartzite rocks and are undoubtedly the same age. Certain forms from the slate of the Northup m Central Rawdon, believed to be of organic origin, have led som suppose that they were newer; but a large number of specimens lected here by Mr. Fletcher in 1890 and last summer by the wri have been found on microscopic examination by Mr. T. C. Weston be merely dolomitic concretions.

"The Rawdon slate belt is plicated in a synclinal and anticlinal f The latter passes a short distance north of Central Rawdon, and Upper Newport, brings up along its apex a narrow ridge of the lo quartzite group with numerous quartz veins, some of which (one i

* Summary Report of the Geological Survey, 1890, page 40; Trans. N.S. Sc., Ser. 2, Vol. 1, page 137.

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west of Upper Newport post office) were prospected and found to be auriferous. Quartz veins of great width and length, cutting these up-tilted slates at a right angle, are very numerous, and those worked so successfully a few years ago at Central Rawdon and found to contain such rich pockets, belong to the group of true fissure veins. No doubt these veins were formed by segregation out of the adjacent auriferous slates, but it is not probable that gold is as uniformly distributed through the whole thickness of these slates as it is through the 'whin' series, and moreover as no structural indication is yet known as a guide to the location of the auriferous cross veins, these slates will never be as tempting a field as the 'whin' series, where systematic prospecting along anticlinals directed by experienced mining engineers, well acquainted with the peculiar structure of the Nova Scotia gold districts, is likely to be successful. These Rawdon slates are, on the east, north and west sides unconformably covered by the Lower Carboniferous rocks."

New Brun-
swick.

NEW BRUNSWICK.

Gold and Silver.

Gold and
silver.

Beyond a little prospecting, there is nothing to report. Mr. Brummell visited the province during the summer and gleaned the following information regarding one of the argentiferous galena veins of Gloucester county :

Millstream,
Gloucester Co.

"*Millstream, Gloucester County, N.B.*—No work was performed here during the year beyond tracing the vein for about two miles to the eastward and the mining and hauling of ten tons of ore to Bathurst station.

"The owners have kindly furnished us with the following analyses of samples taken out by themselves during the year :—

	No. 1.	No. 2.
Copper.....	0.14 per cent	.....
Gold (per ton 2,000 lbs.)	0.26 oz.	0.24 oz.
Silver " "	14.20 oz.	11.00 oz.

No. 1.—By Ricketts and Banks, New York.

No. 2.—By H. O. Hofman, Boston.

From vein further east,

By A. E. Macintyre, St. John :

	No. 1.	No. 2.
Lead.....	12.63 per cent.	6.30 per cent.
Silver (per ton 2,240 lbs)	14.30 oz.	8.10 oz.
Gold.....	0.70 dwt.	less than 0.50 dwt.

QUEBEC.

Gold.

The gold mining of this province consisted as in former times of the working of the auriferous gravels of the Chaudière in the county of Beauce, and of the Ditton district, in C. county. In the former district an encouraging renewal of activity is apparent, and further attention is being paid to the quartz veins with a view to their receiving a practical mill test.

On this subject Mr. Brumell, who visited the district division, furnishes the following notes:—

“A short visit was paid to the Chaudière gold region where operations were confined to two points, viz., the Gilbert river and Du Loup, both in Beauce county.

“On the Gilbert river, Mr. W. P. Lockwood had a force of men employed on lot 13, DeLery concession. Here operations are being carried on by means of a slope 200 feet deep to a level connected with a shaft about 175 feet to the south. The shaft was sunk 175 feet through the following section:—

- 8 feet surface materials.
- 13 “ quicksand.
- 43 “ blue clay.
- 1 “ gravel.
- 15 “ bed rock, slate.

“From these levels were run 140 feet to the south and 183 feet to the north where connection was made with the slope through which all the gravel and ‘dirt’ is taken out. From these main levels shafts had been run, taking out the gravel throughout the entire length of the old channel. The plant and appliances at the works consisted of one steam hoist, one Cornish pump, one 12 horse-power boiler and horse-whim.

“The pay dirt averages about six feet thick and is said to amount to about \$75,000 per acre, though in the present workings they are obtaining only about three ounces to the ‘cap’ of 8x10 feet; this at the usual price of Quebec gold, \$18 per ounce, would be \$54 per ‘cap’.

“According to Mr. Lockwood, the old river channel has been worked out from lot 21, of DeLery, to lot 11, of St. Charles, as well as through a considerable number of lots in the 1st range N.E., near the Chaudière river.

“On the quartz reefs of the seigniory little has been done beyond the locating of some thirty-five veins which occur between the Gi

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river and the village of St. François, on the Chaudière. They are said to average over five feet in width and to afford a free milling ore.

"On the Du Loup river near its confluence with the Chaudière, Messrs. Gendron and Haycock have undertaken extensive operations for the fluming of the river, and intend erecting a small mill for the treatment of ores from the many reefs upon the river in the township of Jersey and seigniory of Linière.

Ditton.

"In the township of Ditton, Compton county, a small amount of development work was done and sluicing begun on the Little Ditton river, and prospecting carried on upon the Salmon river and tributary creeks, though to what extent is not known, as the district was not visited."

Silver.

Silver.

The only silver ores as yet discovered in this province are found in veins carrying galena, which is more or less argentiferous and is sometimes accompanied by zinc blende and copper sulphurets. These have never been worked very extensively, although more or less exploratory, and development work is always being carried on in this direction.

Lake Temiscamingue Mine.—This mine was not operated during 1892. It has been referred to in past reports.

There was no activity in this direction to report for the year, other than a slight amount of prospecting work.

Ontario.

ONTARIO.

Silver.

Silver.

The officers of the division having been busy in other directions, were unable to visit the silver mines of the Thunder Bay district. However, from information received from reliable correspondents in the district little or nothing was done beyond prospecting and test work on some of the less known properties. All the larger mines were closed during the year, various reasons being given.

It will be useful here to reproduce the notes of the Ontario Government Inspector of Mines as given in the report of the Provincial Bureau of Mines for 1892. This gentleman writes as follows:—

"The Murillo mine as well as the St. Joseph mine on the adjoining lot have been lying idle during the year.

"The Beaver mine suspended operations both in the mine and at the mill shortly after my last visit in July, 1891. A watchman has the care of the property.

" At my visit to the Badger mine in June a few men were employed in unwatering one of the shafts and doing a small amount of work in the way of refitting some of the dilapidated places. The superintending work on this mine, so largely productive in former years, as was the Beaver, I was informed was not for want of rich bodies of ore, but must be attributed to other causes, the chief one being the depreciation of silver.

" In June I examined the Climax mine, which is on mining locality No. 145, half a mile north of the Porcupine and about one mile and a half from the Silver Creek station on the Port Arthur, Duluth and Western railway. To which a good wagon road has been built. The property is owned by capitalists of Minneapolis and Canada, no company having yet been formed. J. H. Sinclair of Minneapolis, who resides at the property, has the entire superintendence of the works. There are several parallel veins on the property, running 30 degrees north of east and 300 feet apart. The mine has been worked constantly since the month of December, 1891, with a force varying from six to thirteen men. Previous to the present owners purchasing the property some development work had been done in sinking two shafts to the depth of 100 feet each, one on each vein, and also running in a drift on the No. 1 or south vein about eighty feet. Another drift was run on the No. 2 or north vein thirty-five feet.

" Under the present management the level on No. 1 vein has been continued an additional 128 feet, making its total distance 200 feet and following the mineral from the place of its intersection at 100 feet from the mouth of the drift, thus opening the vein 158 feet to a vertical depth of thirty-one feet from the former drift and the level has been driven in 135 feet, exposing the vein for a distance of seventy feet. In the first level, at a point fifty feet from its entrance a winze has been sunk thirty-one feet to intersect the level below.

" On vein No. 2 the old level was continued a further distance of forty feet, making a total of seventy-five feet from the entrance and following the vein the entire length. At a vertical depth of 100 feet from this level another one was driven in 213 feet, following the lead for 123 feet. There is a valuable showing of ore in this mine.

" These workings are in slate formation, and the gangue consists of calc and fluor spar, quartzite, sulphide of iron and zinc blende, hematite and black silver, with a small portion of galena. A force of 10 men was employed.

" Captain Rapsey informs me that West Silver Mountain mine has been closed since May 1st on account of the death of Mr. Drake, the owner of the property. It was expected work would be resumed.

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soon as the necessary arrangement could be made with the estate of the deceased. At the time work was suspended shaft No. 2 had reached a depth of 142 feet.

" On the second level drifts had been extended to the distance of 364 feet west and 198 feet east. Drifting in the first level, which is thirty-seven feet from the surface, had been continued to the extreme distance of 151 feet west, and at a point 125 feet from the shaft a winze had been sunk to the level below.

" Since my last report but little work has been done in the lowest level. A considerable quantity of valuable ore had been taken out of the mine and shipped. Mr. Rapsey states in a recent letter that 'the mine never looked so well as when shut down.'

" Discovery of the Gopher mine was made about two years ago by I. S. Roberts on the south half of lot 11 in the fourth concession of the township of Strange. The property is owned by a number of capitalists of Minneapolis, and the company formed is known as the Gopher Gold and Silver Mining Company. Capital stock \$100,000, all paid up. Mr. Howard of Minneapolis is the managing director; office, 707, Globe Building. Mr. Roberts has the superintendence of the work at the mine.

" Work was begun a year ago last April and continued until Christmas with from six to nine men. One shaft was sunk 104 feet on a vein of ten feet in width, and at fifty feet from the surface a drift was run in fifty-two feet on the vein and a cross-cut of a few feet was made. Assays from these workings show value of the ore running from \$5 to \$60 per ton. At a distance of 250 feet from the first, a second shaft was put down twenty feet on vein matter. No. 3 test shaft was sunk between the first and second twenty-one feet, in which was found a good showing of native silver.

" The machinery consists of one 20 h. p. boiler, a 10 h. p. engine and a pump; but so far the pump had not been required for use.

" An engine house and good dwelling house, blacksmith's shop and drying room for the men have been put up. It was expected work would be commenced again about the first of August.

" Work on the Augusta mine was suspended in November, 1891. Since the former report about sixty feet of drifting has been done and a shaft twelve feet deep sunk at a distance of 130 feet from the mouth of the last drift opened. In this shaft it is said good ore was found. Mr. Griffis, the manager, informed me that the property would be worked again about the first of September.

"Silver Bluff mine was lying idle. Mr. McEwen, the manager of the Shuniah Weachu or East Silver Mountain mine, informed me that work had been discontinued at this mine October, 1891. No additional work except exploring had been done since last report. Bluff, Crown Point, Silver Centre and Palisades mines were also lying idle.

"Mr. McEwen has charge of a new property known as Gopher mine, comprising 160 acres, situated on the fourth concession, Strange, six miles east of Silver mountain. It is owned by a company in Minneapolis; capital stock \$150,000. I found twelve men employed under Captain James. A vertical shaft has been put down 160 feet on a quartz vein. Boiler and engine 16 h.p., with suitable machinery. An engine house and comfortable boarding camp have been built.

"The Empire mine location comprises 135 acres, being the second concession of O'Connor, and adjoining the Beaver Lake. Work was done as early as 1889 by sinking a test shaft four feet on the north part of the property. An opening was also made on the hill side on the south part of the location, opening a promising ore, and a shaft was sunk fourteen feet. North of this opening, a shaft has been sunk sixteen feet deep, exposing good ore. West of this opening another shaft has been put down twenty feet. Work has been retarded on the property on account of inflow of water. This mine gives an exhibit of very rich ore.

"The property known as R20 mine is situated in the town of Scoble, comprising eighty acres. It is about twenty-five miles from Port Arthur, adjoining Rabbit mountain, and is owned by Brimson and R. E. Mitchell, both of Port Arthur. This mine is due south one and a quarter mile from the famous Beaver Lake, has been worked since November, 1891, and had a force of seven men employed when I was there. T. R. Walker of Port Arthur has the management of the work.

"A vertical shaft seven by ten feet was sunk to the depth of eight feet, following the vein, which is from three to four feet in width, * * * * * The shaft was sunk in the trap rock, but the slate formation was expected to be reached at an additional depth of from fifteen to twenty feet. Hoisting done by a whim. A boarding house, sleeping camp, dry house, blacking and a blacksmith's shop have been erected.

"Upon examination of the Lily of the Valley property, which I visited on June 14th, I found that two distinct veins of ore had been opened and traced for a distance of about fifty rods. Their course is east and west.

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"Starting at the farthest point east, the two veins are about 300 feet apart. The north vein runs due west and the south vein north of west, so as to form a junction with the other vein at a point fifty rods west. The first discoveries were made on the two veins nearly opposite each other, and about midway between the two extremities. A shaft was sunk on the south vein a little west of the place of discovery to the depth of twenty feet, showing the vein between well defined walls to be three feet in width. At a distance of 200 feet east of this shaft, on the same vein, another shaft has been put down to the depth of nine feet. The first five feet passed through clay, when rock consisting of spar and quartz was reached. The four feet of sinking in the rock showed the vein to a width of six feet. Work was being done in this shaft at the time of my visit.

"On the north vein, which is now designated the main vein, and nearly opposite the first shaft, a third shaft has been sunk to the depth of thirty feet, exposing the vein to a width of ten feet, but the full width had not yet been determined. The mineral has been followed from the surface to the bottom of this shaft. Work had been suspended on this shaft for two months, and it was partly filled with water. At this time about twenty tons of high grade ore had been taken from the mine.

"Since writing the above, a recent note from Mr. Hugh Munroe, Crown timber agent at Port Arthur, informs me that a shaft has been sunk to a depth of twenty-five feet, with a showing that is really good. He states: 'I saw ore that would assay \$7,000 per ton.'

"I have been informed that the main vein has been traced by surface working a distance of three miles east and one and a half mile west."

Apart from prospecting and some little development there is nothing to note regarding the deposits of argentiferous galenas scattered throughout the province.

Gold.

Gold.

The gold-bearing veins of this province continued to receive attention. The mines have so far, however, hardly progressed beyond the development stage, so that the province has as yet remained in the background in the matter of the production of gold.

The chief features were to be found in the renewal of operations in sundry gold-bearing veins in the Madoc and Marmora district in Hastings county; the testing of several veins occurring in the Huronian belt of rocks extending from Sault Ste. Marie to Sudbury and beyond

in Eastern Algoma and in the reopening of some of the chief the same formation around the Lake of the Woods in Algoma, at which latter place several mines were erecting new plants to treat their ores.

None of these were visited by any of our officers during the year, but the subjoined interesting details reproduced from the report of the Provincial Mining Bureau will give an idea of the nature of the operations inaugurated.

"The Sultana mine is situated eight miles from Rat Portage Indian reserve, location X42, and is owned by Messrs. John Caldwell of Winnipeg, holding fifteen-sixteenths, and H. Henessy of Rat Portage, one-sixteenth. Mr. Caldwell holds the mineral claim on the Indian reserve and B38, comprising 40 acres. Mr. W. M. Caldwell has the management of the property. A few men were at work at the beginning of the year, and in March the force was increased to eight, who had been constantly employed up to June, the date of our visit.

"The place of working is near the landing or dock, and the ore is removed from the opening in wheelbarrows to the place of shipment. An open cutting has been made to the distance of 250 feet in the east direction, following the side of the lake, and has been worked to the depth of fifteen to eighteen feet, showing a width of vein of from seven to ten feet. The lead has been traced between granite and slate to a distance of about twenty chains. The lowest cutting is only five feet above the high-water mark of the lake. About 130 tons of ore had been mined and removed to the dock ready for shipment to the reduction works at Rat Portage. Other openings had been made in the property the previous year. One which I especially noted is about 500 yards in a southerly direction from the present workings, on a steep elevation, at which 350 tons of ore had been mined and taken to the mill at Rat Portage. A comfortable boarding house, a blacksmith shop and convenient docks have been built. It was intended to put on additional force and use steam power for drilling and other purposes so that the ore could be properly treated at the mill in the town.

"A force of thirty-two men was employed at the mine and mill at the close of the year. Mr. Margach of Rat Portage in a recent communication states that a stamp mill, with rock crusher for pulverizing and classifiers for concentrating the ore, is in successful operation at the mine. I note also by a late communication through the papers that a fine brick has been turned out of the works as proof of the value of the ore and the successful method of treating it. On Sultana Junior the same work was then at work.

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"The Northern Gold Company, formerly known as the Gold Hill Company, are engaged working their prospect, which is situated on the mainland twenty miles south-east of Rat Portage, and contains 906 acres held in fee simple. This discovery was made eight years ago by Mr. George Dulmage, the present superintendent of the work. D. B. Burdette of Belleville is president, and J. R. Wright is the business manager. Ten men had been employed for the past year and their number was increased to thirteen when I visited the property. The workings consist of a shaft sunk to the depth of twenty-eight feet, with other openings following the lead for at least a mile. Shaft No. 2, the present place of working, has reached a depth of forty-five feet at an angle of 45 degrees, following the mineral between well-defined walls. The vein matter is nine feet in width, with about three feet of pay streak.

"A carload of the ore taken from these workings had been sent to Minneapolis to be tested by the Leede process, and so satisfactory was the trial that an order was given for a plant to be put up at the mine, although formerly stamps and other machinery of the ordinary class for a mill had been ordered; these were abandoned. The whole of the plant for the new process was expected to arrive and be placed in position for work in a month or two. The boiler is of 40 horse-power. The ore will be roasted by gas generated from petroleum, using twelve barrels daily. About 150 to 175 tons of ore were ready for treatment, and by the Leede process this ore will be reduced to bullion. A tramway is now being constructed from the mine to Moon bay, a distance of one and a half mile, which will be in use shortly. Through a reliable correspondent I am informed that twenty-four men were working on this property at the end of the year.

"The Homestake mine is on a strip of the mainland at Yellow Girl bay, about 25 miles in a southerly direction from Rat Portage, and is owned by the Homestake Company of Algoma, with capital stock of \$300,000, in shares of \$1 each. About 65,000 shares have been disposed of, and the proceeds are to be used for development purposes and constructing a mill at the mine.

"Mr. Heldrith, a member of the company, is manager of the works, and at the time of my visit had mined about fifty tons of ore, twenty-five of which had been taken to the reduction works at Rat Portage. He had a contract to deliver 1,000 tons at Rat Portage, which he expected to accomplish at the rate of thirty tons daily. The proceeds are to be used for the further exploring and developing of the property.

"A letter in January, 1893, from William Margach, Crown timber agent, states that ten men are at work on the mine, and Messrs.

Heldrith & Chadwick have a stamp mill which they propose operation.'

"The Dead Broke mine is located on P64, Red Rock isls twenty-two miles in a southerly direction from Rat Portage owned by Jeff Heldrith.

"Work on this mine was commenced in April last with ten the vein has been stripped fifty feet in length and nearly the width. A open cut has been made twenty feet in length a feet in width and a few feet in depth, from which about seven tons of ore have been removed, and showing by frequent assays \$7 to \$133 per ton; twenty-five tons of the ore have been the reduction works to obtain a mill run. The work was interrupted by the inflow of water, and a new opening has been at the distance of 130 feet from the former one and the tunnel driven in twenty-five feet. It is intended, I was informed on an increased force and work the property on an extensive

"The Gold Creek mine is situated near Pine Portage bay, from the point at the head of the bay. The location comprises P 347, and is owned by Messrs. E. H. Kendell, Samuel and Joseph Thompson, all of Rat Portage. The discovery was in 1890; work was commenced with a force of seven men in of 1891, and has been continually carried on under the direction of G. F. Ernst, who has had large experience as a miner and holds the property under lease. A vertical shaft has been sunk to a depth of fifty feet, following a vein with average width of nine feet to the surface to the bottom of the shaft. The shaft is well timbered to a depth of fifteen feet through the clay and sand, where a firm foundation has been reached with well defined walls requiring no lining. Two test pits have been sunk, one eight feet on a vein of ten feet width, and the other sixteen feet deep on vein matter of four feet width. The vein has been followed on the surface by opening intervals for the distance of 500 feet west, and in a southerly direction for 2,000 feet. A force of seven men was employed at the date of my visit in June.

"About 300 tons of ore had been taken out and was being carried by tug to the reduction works at Rat Portage for treatment. The place of shipment is at Heenan's point, a distance of one-third mile from the mine, where a convenient dock has been built. The ore which was being shipped had been taken to the dock in the summer season. A good roadway was being constructed from the mine to the dock.

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"A good boarding house and shaft house have been built, and the whole of the work in and about this mine has been done in an exceedingly neat and substantial manner.

"Eight miles from Rat Portage, and near Sultana island, the Ontario Mining Company own a location on which a shaft has been sunk to the depth of fifty feet, from which excellent samples of ore have been taken. The property is owned chiefly by Winnipeg capitalists.

"The Winnipeg Consolidated Gold and Smelting Company own a property on Big Stone bay, eighteen miles out from Rat Portage. Several years ago this property was worked for one year. A shaft was put down 120 feet and drifts run in with such excellent results that a stamp mill was put up. The ore was of good grade.

"The Pine Portage mine is situated one mile inland from Pine Portage bay, and about eleven miles from Rat Portage. A shaft has been sunk 120 feet and about fifty feet of drifting done. The property is regarded as valuable, and a watchman resides upon it. Mr. Dobie, one of its chief owners, stated that it was probable work would be resumed during the present year.

"The Climax mine, owned by A. Egan of Winnipeg, is situated on Big Stone bay, about ten miles from Rat Portage. From an open cut in the side of the hill 600 or 700 tons of ore have been raised, most of which has been taken to the reduction works at Rat Portage for treatment; thirty-six assays showed the average value of ore to be \$19 per ton.

"The Keewatin mine is situated on Hay island, ten miles from Rat Portage, one of the largest islands of Lake of the Woods, which may be regarded as a lake of islands. It is owned by Good & Jones, of Winnipeg.

"On the Heenan mine, which is one mile south of the Keewatin, a fifty foot shaft has been sunk; it is the property of the owners of the Keewatin mine.

"On Boulder island, containing twelve or fourteen acres, a discovery was made a few years ago, a considerable amount of development work done, and a mill put up, which was afterwards moved to the Consolidated mine. The property is owned by William Gibbons and others of Winnipeg.

"On Fish island, near to Boulder, a promising discovery was made seven years ago, and the property was obtained by a company of capitalists from California and worked to a limited extent. One shaft was put down thirty feet, when the work was suspended for the same cause as on the Boulder and other properties—a disputed title.

"The El Diver mine is on location P351, which comprises eight and is situated two and a quarter miles north from Rossland : Canadian Pacific railway, eight miles east from Rat Portage. The property is owned by Messrs. J. W. Webster and E. W. Gaylord, Cleveland, Ohio. Mr. Gaylord has charge of the works of the mine.

"Work was commenced in October, 1891, with a force of five men which was increased to seven during the winter. Ten men were employed in June at the time of my inspection. The principal shaft has been sunk to a depth of sixty feet, following the vein matter from the surface with an average of two feet of pay ore. The work was done by contract, and about 200 tons of ore were on the dump.

"A mill for concentrating the ore has been erected, and the machinery would be in place and all running in about a month. The concentrates were to be treated at the reduction works in Rat Portage. It was intended to continue operations both at the mine and mill with a sufficient force to fully test the value of the mine, and to increase the work as the development would warrant. The owners hold the property with a view of working it, rather than as a speculation. A dwelling house with office was being constructed, and a good board house and blacksmith shop have been completed. Other prospecting was being done on the property. I directed the attention of the owner to some necessary work to be done for the protection of the men in walling off the ladder-way in the shaft and timbering new surface.

"Mr. Webster also owns P288, comprising eighty acres, known as Caribou, about half a mile from the station, upon which some development work has been done with excellent showing of mineral.

"The last of October I received a communication from Mr. Gaylord stating that the necessary work for the safety of the mine had been properly done, also that the shaft had been continued to the depth of seventy-five feet, and a shaft house was being built. A friction hoist has been purchased from the Jenckes Machine Company, Brookfield, Que., which will be run by rope belt from the mill. The mill building has been increased to double its size and the mill dam is greatly increasing the supply of water for power. The dwelling house with office have been finished, an ice-house built, and also an addition to the barn and stabling accommodation.

"The pulverizer which was on hand when I was there has not proved a success, and a Crawford mill has been put in its place. I intended, Mr. Gaylord writes, to push the work forward through the winter both in mine and mill if water supply and weather should permit. He also writes: "We have purchased a property two

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south of Rossland (eighty acres) known as the Treasure. The ore there carries free gold in abundance at the surface ; we are down about twenty-eight feet. The showing at the bottom is not as good as at the top. The vein measures from two feet to six inches wide. We have erected several log buildings, such as boarding house, blacksmith shop, ice-house, barn, magazine, etc. We intend to push the work on the shaft this winter, but shall not erect a mill before spring."

"About the middle of June I visited the Gold and Silver Reduction Works in the town of Rat Portage. The capital stock of the company is \$200,000, with about one-half this amount paid in and used for the construction and outfit of the mill. Charles Brent has the superintendence of the work and J. P. Larkins of Rat Portage is the secretary of the company. Through the courtesy of these gentlemen I had an opportunity of carefully examining the works, and obtained through the superintendent a full explanation of the process being adopted in the extraction of the precious metal from the ore. The mill had just started up and about nine tons of ore were running through daily with the exception of being treated in the chlorination department, which was not yet fully completed. A large quantity of ore was being delivered on the dock at the mill for treatment, and it was expected a full supply would be obtained from the mines operated in the vicinity to keep the works constantly running. I forego giving an account of the mill taken at the time of my visit, as by the favour of Mr. Brent the following note has been recently received describing the process, results, changes and prospects of the reduction works and other mills, and the condition of several of the mines, which may be permitted insertion here as a matter of much information and interest. Mr. Brent writes :—

"As to the reduction works, I regret to say that we shut down in August of last year owing to the fact that the pulverizing machinery proved useless. Our plan in brief was as follows : The ore (gold) is crushed wet to forty mesh, the free gold extracted on plates and by pans and settlers ; the tailings from these were concentrated. The concentrates were roasted in a reverberatory furnace and treated by chlorination.

"I am glad to be able to inform you that a wealthy American syndicate has purchased the reduction works and will put in new and suitable machinery to properly reduce the ores of this district.

"As to the mines : things look very favourable at present, and if appearances are to be trusted a boom in mining will take place in the spring.

"During the fall I put in a ten stamp mill at the Sultana, which is in successful operation and is a dividend payer. I am sorry, however, that very little has been done in the shape of mining development. The machinery consists of a hoist to bring the ore to the surface, a seven by ten Blake crusher; ten stamps of 850 pounds each, with batteries of five stamps each, with inside copper plates and twelve electro-silvered copper tables. The tailings are treated by concentration over two improved Frue vanners.

"I am at present in charge of the mill at the Bulldog. We are putting in two ten-ton Crawford mills. The company is pursuing a policy of vigorous underground work and at present (fifty feet) the mine looks well.

"Our next neighbours at Gold Hill have completed a new mill to be operated by the Leede process. This is a process of roasting ore manufactured from crude petroleum, followed by amalgamation with pans, gold plates and Cook amalgamators.

"At the Treasure, south of the C. P. R. at Rossland, they are sinking with good prospects, and will put in a mill in the spring.

"At the El Diver a Crawford mill has been put in place, but they are tied up for water. They are sinking with fair prospects for success.

"The Rajah Mining Co., an English syndicate, is operating on a piece of property five miles from Rat Portage, in a north-east direction.

"The Bullion Mining Co. is sinking a shaft about five miles from town.

"The Homestake Co. is sinking a shaft on Middle island with good showing.

"A large amount of prospecting will be done as soon as spring opens."

"The Ogema mine is situated in the new township of Dorion, about eight miles from Ouimet siding, C. P. R., forty miles east of Arthur and seven miles east of Pearl River station, which is the headquarters and express office for the company.

"The Ogema Mining and Smelting Company was organized under the laws of New Jersey and Ontario, with a paid-up capital of \$150,000. The property comprises 400 acres. Mr. John C. Smith, one of the shareholders, is manager for the company and has charge of the work at the mine. Work has been continued since September, 1891, when it was begun with a force of five men, but increased to ten at the time of my visit, June 25th. A good team is used by the company in assisting to build the government road leading out in the direction of the mine, and hauling in machinery and supplies for the mine.

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"In addition to considerable surface workings, a shaft of eight by ten feet has reached a depth of fifty feet, following the lead of galena and gold ores from the surface to the bottom. The vein is the full width of the shaft at the place of working." According to the same authority pockets of richer ore are said to occur at places in the vein yielding by assay as high as \$668 in gold with \$8 in silver. This richer ore is barrelled. A large amount of lower grade ore is also to be found in the dumps and workings assaying about 65 per cent of lead and \$7.50 in silver.

"The mine is provided with a good outfit for convenient and rapid working, consisting of one 15 h. p. boiler and one 12 h. p. engine, a Copeland & Bacon hoist machine, machine drills, steam pumps, etc. A pony saw-mill has also been erected to cut the lumber and fuel required at the mine.

"Suitable buildings have been constructed; shaft-house, engine-house, blacksmith's shop, cooking and sleeping camps; also a superintendent's residence with office attached, a warehouse and stabling sheds for horses and implements, and a magazine. The mine was in a good and safe condition.

"In a communication received from the manager of the mine since the close of the year he informs me that the mine is still being vigorously developed, although work has been suspended for a short time on account of the extreme cold. Two shifts of men were to be put on almost immediately. In reference to the Crawford mill he writes: 'Owing to the immense amount of oxide in our ores, the Crawford mill did not give good results. It is a well-known fact that amalgamation is prevented by oxides, particularly that of iron. The Crawford mill, however, is the most perfect pulverizer and amalgamator I know of, and I believe is doing a grand work on the free milling ores at Rat Portage.' He also states: 'We have increasingly strong indications of a rich deposit of gold and silver.'

"A large amount of prospect work has been done on the property known as the Ophir mine, north of Thessalon, and very excellent results obtained. Specimens of nuggets have been widely distributed among mining men. Rare specimens, I learn, have been forwarded for the Columbian Exposition at Chicago. The property has been acquired by a syndicate of Duluth capitalists.

"The Creighton gold mine is situated three-quarters of a mile from the Vermilion river, in the township of Creighton. It is being worked by an Ottawa syndicate, of which Mr. Seybold is president, and the work on the property is under the direction of J. R. Gordon, C.E. Two lots, 11 in the fourth and 11 in the fifth concession, have been

located and development work has been done on both. When at the mine the last of June a shaft had been sunk fifty feet at an incline of forty degrees, following the vein from the surface. The outcropping quartz, bearing gold, could easily be traced for 500 or 600 yards south, Ontario.

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Discovery and
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* * * * * The vein matter at the place of Gold, working is about fifteen feet wide and contains gold of the value of \$12 to \$20 per ton. A 20 h. p. boiler and a 15 h. p. engine are used for running the steam drill, and a pulsometer pump, discharging when operated a 2½-inch volume of water. Six or eight men were employed when I was there.

"A good road has been built from the mine to the river, down which the chief supplies for the mine are brought, and a comfortable log building has been put up for boarding and lodging the men.

"I visited the property of George Bennett of Chelmsford on May 30th, which is four and a half miles from Chelmsford station on the main line of the C. P. R., west of Sudbury twelve miles.

"This property is on lot 6 of the first concession of the township of Balfour, and was being worked for gold and silver by a few men. A shaft had been put down thirteen feet and drilling thirty-five feet from the bottom of the shaft. About 200 feet from this place another boring has been made to the depth of twenty-five feet. The surface formation is slate, with quartz underlying.

"Assays have been made of ore taken from the surface and from the bottom of the shaft, and also from the deeper borings, showing from \$2 to \$8 of gold and from \$1 to \$5 of silver per ton. A good level road has been built from the station to the mine.

"A good property was located in the fall of 1891 about twenty miles east of Sudbury, thirteen miles north-east of Wahnapiatae station on the Canadian Pacific railway, and six miles east of Wahnapiatae lake, near lake Kookogaming or Rabbit lake. The discovery was made in a swale, where in drift boulders free gold was found in the form of small nuggets. The property was obtained by Colonel Shaw, A. McArthur and others of Toronto, who engaged Peter McKellar of Fort William to examine and report upon the property. Mr. McKellar traced the boulders to their place of origin, a distance of only 200 feet, where several segregated veins were found. An assay test made from one of these veins by Mr. McKellar showed as high as \$2,400 per ton of coarse free gold. Frequent assays showed quantity, from traces to the amount named. Other large well defined veins are found upon the same property which show free gold at the point of exposure, but are chiefly covered.

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Gold.

"It is intended to prosecute further work at an early date to test the value of the property and, if satisfactory, operations will be commenced on a large scale and suitable machinery introduced for efficiently working the mine.

"From the present indications Mr. McKellar, who gave me the foregoing description, regards the property as one of encouraging promise.

"A mine containing some gold and silver was discovered in 1891 by A. D. Cummings of Nipissing on the south shore of Lake Nipissing, about two miles west of the mouth of South river. A limited amount of prospecting work was done in the early part of the year by John McAree, P.L.S., at the instance of A. A. Wright, 273, Chestnut street, New York. The work done was in making excavations at several points on the vein and in sinking a shaft six by eight feet to a depth of thirty-five feet. The vein is about twenty feet wide, and the gangue consists of quartz, country rock and gneiss.

"To fully test the value of the property Mr. McAree writes that the shaft will have to be sunk much deeper; 'that there is a good strong fissure vein admits of no doubt.'

Belmont
gold mine.

"In May six men were engaged in working in the Carscallen shaft of the Belmont mine, in the township of that name, which had reached the depth of 100 feet, being twenty-five feet additional since my last report. The gangue matter contained about 15 per cent of sulphurets. At seventy feet a level has been run a short distance, and a cross-cut shows the vein to be fifteen feet in width. In the O'Neil shaft additional sinking of ten feet has been done, making this shaft thirty-four feet and showing a similar grade of ore as that taken out previously. A few additional feet in depth has also been made in the Strickland shaft. The four Crawford mills set up in the village of Marmora had been run at the date mentioned to the extent of treating 220 tons of ore taken from the mine, which ore was found to be highly refractory, carrying iron and copper pyrites. The results as given to me showed a saving of ninety-eight per cent, the assays indicating but traces of gold in the tailings not to exceed two per cent.

"In the process of treatment the ore is passed through a Gates crusher and then introduced to the top of the mill by an automatic feeder in a continuous stream. It is there pulverized by nine balls of about seventy-five pounds each, which are constantly kept in rapid motion by a revolving disc which produces both a circular and lateral revolution, and by which the ore is ground to an impalpable mass, completely disintegrating the gold from the rock which then settles into the trough or sink at the bottom of the mill and forms an amalgam with the quicksilver, which has been

supplied to each mill to the extent of 125 lbs. There is a constant stream of water injected into the mass at the bottom of the mill, which flowing over the disc serves the double purpose of keeping the quicksilver pure and causing an overflow about two feet above, carrying with it the pulverized silica or quartz and other impurities and leaving below the precious metal. The ore is reduced to a fineness to allow of 60 per cent to pass through a 200 mesh, 80 per cent to pass through a 120 mesh, and all to pass through an 80 mesh screen. The loss of quicksilver in the test run was 2 lbs., the entire quantity used being 500 lbs. for the four mills. By the ordinary process of retort the gold was run into a brick and the standard reached 92½ per cent of gold and a small percentage of silver.

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"In August, at the time of my second visit, the mine was not being operated. In a letter recently received from A. W. Carscallen, M.P., he says: 'The Belmont mine is in full blast with a large Crawford mill running night and day, and a second one to be added shortly. They have about thirty men employed and everything is moving lively. The vein as it increases in depth is increasing in richness, and the outlook for this property is very bright indeed. I think the shaft is down about 120 feet, and they have started levels at thirty and seventy feet. The property is being worked by Middleton Crawford, the inventor of the mill, * * * * There are no other properties being worked in this section just now.'

"T. D. Ledyard of Toronto, dealer in mines and mineral lands, writes that 'gold has been found in several places on the east half of lot 19 in the first concession of Belmont. This lot is adjoining the one on which the new Belmont gold mine is situated.'

"I have been informed that the Hastings Mining and Reduction Company have six men at work on surface ore of the Galting mine; also that a mill is under construction at Marmora village for the treatment of ore by the Carter-Walker process, which consists in crushing and roasting the ore and forcing vaporized mercury through the pulp, which is afterwards treated in settlers.

"The Crescent mine was lying idle throughout the winter, but reopened early in June. At the date of my inspection, August 10th, forty men were employed at the mine and mill. George McDougall had the management, with Wm. McDougall as assayer. J. N. Baker of Nova Scotia had the charge of the mill.

"Work was continued on the Mackenzie shaft, which had reached a total depth of sixty-five feet in barren rock, crossing a vein of ore however at the depth of fifty feet.

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"The shaft now known as the A shaft was being worked with a few men, in contact with good ore. A considerable quantity of ore was being taken from the large open pit, where the principal work was being done.

"The mine is being worked with care, and apparently it is in a safe condition for the workmen. An open pit near the mill required fencing, which the manager said would be immediately attended to. The mill had been running for only eight or ten days previous, and was treating about twenty tons of ore in twenty-four hours. For description of mine see former report.

"A few tons of ore had just been treated in one of the Crawford mills, but the cleaning up had not been finished, and the results were not known when I was at the mine.

British
Columbia.

BRITISH COLUMBIA.

During 1892 the mining for the precious metals showed some interesting features due to the discovery of many veins carrying rich argentiferous galena ores in the West Kootenay district, details of which are given below.

The extraction of gold from the placer deposits of the province was continued on the usual lines. As previously mentioned this industry, however, continued to decrease as in past years.

Mr. Ingall spent the greater part of three months in examining numerous veins in the Illecillewaet and Kaslo-Slocan subdivisions of West Kootenay district. In reporting to the director, Mr. Ingall summarizes the results as follows :—*

Silver.

Silver.

Notes by E.
D. Ingall.

"It may not be amiss to summarize the conclusions arrived at as a result of the studies prosecuted in the new mining camps of West Kootenay.

"As it was, of course, impossible to properly examine all the mineral deposits known to exist in any of these districts in the time at disposal, selections were made which should, as far as possible, be illustrative of the different districts and varieties of deposits. The local features of these, as far as exposed by the developments made, were carefully studied and illustrative specimens for the museum were collected, together with samples for assay. In the camps tributary to Illecillewaet, on the Canadian Pacific railway, visits were made to the older claims in the immediate vicinity of that place, as well as to

*Summary Report of the Geological Survey of Canada for 1892.

the newer discoveries in the Fish River valley and around Copper hill. These comprise the following claims, viz : The Lanark, Maple Leaf, Isabella, Bluebell, Jumbo, Sanquahar and Cariboo, near Illecillewaet, and the Gold Hill and Copper Hill group of claims. In the Fish River valley the chief points examined were the Elizabeth, Edinburgh, King Solomon, Herringback and Fishburn claims.

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Silver.

"In the Illecillewaet district proper, beyond some prospecting and assessment work little was being done at the time of my visit; but development work was being conducted by Messrs. Ryckman, M.P., and Scott, and by Messrs. Fishburn & Co., in the Fish River valley. The general description of the Slocan veins given below will serve equally for those of the Illecillewaet and tributary districts.

"The Slocan district on the west side of Kootenay lake was visited during September and October:

"These new discoveries, made in the fall of 1891 and spring of 1892, are situated about the headwaters of the Kaslo river, and between there and Kaslo City on the west shore of Kootenay lake. A number of discoveries were made later in the year on the shores of Slocan lake between the Columbia river and Kootenay lake. These could not, however, be visited, owing to lack of time; and for the same reason it was found impossible to visit other discoveries in the Lardo River country and at various other points in the valleys of the Lower Kootenay and Columbia rivers about which very glowing accounts came to hand.

"Kaslo was reached in the beginning of September, and after all necessary arrangements were made the trail up the valley of the Kaslo river was followed to Bear lake, on the divide between that valley and the watershed of Slocan lake and river, and trips were here made to the various groups of claims distributed along the route.

"Bear lake was reached on the 19th of September, and an attempt made to reach the important group of mines on the surrounding mountains, but this purpose had to be temporarily abandoned, owing to the early advent of snow which effectually hid everything at that elevation. Whilst waiting for the melting of the snow, a short examination was made of the Ainsworth camp for the purpose of comparing the conditions there with those of the Kaslo-Slocan camps, and thus connecting the work with that done by Dr. G. M. Dawson in 1890.

"The snow having melted sufficiently, the examination of the Kaslo-Slocan group was continued and most of the chief discoveries were visited. The return of the snow on the 10th of October, however, again prevented the study of the surface showings at the Bonanza King claim, of which nothing could be seen but the tunnel. This

was much to be regretted as it was the chief claim in the Noble Five Group, the discovery of which has led to the rush to the district, and indirectly to all subsequent discoveries. It was, however, yet found possible to see the Freddy Lee and Slocan Star mines on Carpenter creek, owing to their being on a slightly lower level.

"In returning it was intended to visit the Wellington and White Water claims, but the snow having reached the lower levels no further work could be attempted, and the return to Kaslo was made on the 15th of October.

"Much hopeful activity in the direction of prospecting and development work was manifest in this district, and not without foundation, high hopes were prevalent regarding its future.

"Towns were started at Nakusp and New Denver on the proposed wagon route for providing the Slocan claims with an outlet via the Columbia river line of steamers and also to Kaslo which is the terminus of the now completed wagon road, connecting with the Kootenay lake steamers by which ore can be shipped to the smelting works in process of construction at Pilot bay or to any point in the United States via Bonner's ferry on the Northern Pacific railway.

"In a preliminary report such as this it would be impossible to give the results of these investigations, other than in very general terms, and all the detail of the evidence upon which these conclusions are based will be left for the complete report that it is intended to issue later.

"However, of the geological conditions of occurrence of the deposits visited and of their visible extent, etc., the main features are given below.

"Proceeding west from Kaslo, the rocks noticed seemed to belong to two distinct series. A belt of green dioritic schistose and serpentinous rocks, following west north-west along the northern side of the valley of the Kaslo river, whilst south of these the rocks are for the most part black shales and slates with gray interbedded bands, which evidently consist for the most part of carbonate of lime. The general dark colour of this series of rocks, varying from dark gray to black, would seem to be due to the presence of carbonaceous matter, and is in striking contrast, both in colour and structure, with the general green colour and more metamorphic characters of the adjacent rocks to the north. The black shaly series are tilted, in places much folded and also at times indurated. They frequently show local metamorphism, which latter phenomena will probably be found in all places, as it evidently is in some, to be due to the action of the intrusive igneous

rocks which are visible as dikes and masses or areas, cutting both the before-mentioned series.

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"The veins examined show in general the character of fissures cutting the formation, although sometimes conforming along the strike with the inclosing rocks for considerable distances. Where occurring in connection with the calcareous bands of rock, there would seem to be a tendency to make large pockets in connection with the vein, or towards widenings of the vein itself. Strippings on some of these present surfaces of considerable extent, which, however, on further development have proved not to belong to the veins proper. The veins whilst usually found to be more persistent, are generally comparatively much narrower.

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Silver.

"Although they show variations in structure these fissures in general carry galena in ribs, nodules, etc., associated with an ochrey gangue locally termed *carbonates*. This ochrey material is said to assay well in silver in many instances, it being doubtless enriched by the presence of more or less argentiferous carbonate of lead, or, as was plainly visible in some cases, by the presence of disseminated native silver and argentite, doubtless resulting as secondary products from the alteration of the argentiferous galena.

"The galena varies much in texture from a fine blue ore of steely grain up to coarse cube and sometimes shows a ribbed structure. With it in many cases are associated various arsenical and antimonial minerals of silver disseminated through the ore proper. The occasional presence of a certain amount of copper is evidenced by the stains of malachite and azurite, which probably originate from the weathering of the tetrahedrite as well as from copper sulphurets, which occur in slight degree. The general run of the reported assays of specimens from the district is high, averaging in the hundreds of ounces, and occasionally even reaching to the thousands, the latter results being quite possible for separate specimens when the presence of the richer silver minerals is borne in mind. At one mine which has made considerable shipments, it is claimed that these have averaged \$200 per ton, and the conclusions based on the general evidence obtainable would seem to justify the expectation that the yield of the district will be found to average high in silver.

"The galena-bearing veins which cut the green schistose and serpentinous rocks, present to the eye a generally similar appearance to those found in the shale and argillite series, except of course for the absence of the associated pockets of ore mentioned in connection with the calcareous bands.

"What may prove an interesting discovery was reported late in the season from the Whitewater basin, some prospectors having brought in specimens of quartz which, according to local assayers, averaged very high in gold. No further particulars are, however, available, as the intended visit to the place was prevented by the advent of the snow.

"Assuming then that, in actual working, the ores should be found in shipping lots to maintain their high content of silver, which would seem probable in most cases, a bright future may be predicted for this district if those interested will only observe and act on the financial and economic principles necessary to success.

"The completion of the wagon road from Kaslo into the centre of the district will be of great value in the working of the mines and the existence of smelters in Canadian territory at Pilot bay, Revelstoke and Golden will doubtless prove of great assistance when a continuous supply of ore shall be forthcoming.

"The projected railroads to give connection with the Canadian Pacific railway at Revelstoke, and from the Slocan divide to Kaslo, will doubtless be constructed when the veins are worked on a more extensive scale.

"The assays made of the selected specimens collected during the season show the following general results :—

"In the Illecillewaet district four assays of galena from different points varied between 18 oz. and 73 oz. of silver per ton, the pyritous ores of copper being found, in the one sample assayed, to carry silver also.

"The galenas of the Fish river sub-district gave results running from 39 to 318 oz. of silver per ton. A sample of the 'ochreous' material locally called 'carbonates' showed 692 oz., and some of the zinz-blende nearly 6 oz. of silver per ton.

"The assays of galena from the various veins in the Kaslo-Slocan district resulted as below :—For those occurring in green schistose and dioritic series of rocks, six assays gave results ranging from 38 to 146 oz. per ton, averaging over 90 oz. One assay of a specimen of zinc-blende showed silver to the extent of 26 oz. In the same district the galenas from veins occurring in the black argillite series of rocks averaged in some thirty-one assays, 150 oz. per ton, ranging from 30 oz. to 520 oz. per ton. Assays of zinc-blende returned from 26 oz. to 73 oz. per ton. The ochreous 'carbonates' occurring with the galena yielded very variable amounts of silver, the lowest return being 20 oz., the highest 1,630 oz. per ton. This great discrepancy is due to this ore being a mechanical mixture only, which is often enriched by secon-

dary deposition of native silver and the richer silver minerals. In the whole series of assays made, numbering some sixty-five in all, gold was absent, except for mere traces found in three cases.

"The ton referred to is that of 2,000 lbs. For further details see the forthcoming report of the Chemical Branch of the Department."

For the sake of completeness the part of the report of the Minister of Mines for this province giving details of discovery and of development work done throughout the province are here reproduced.

They are given by the government agents in the different districts and deal with workings both on placer deposits and veins.

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Discovery and development in British Columbia.

Silver.

Notes from Reports of Minister of Mines for B.C.

Gold.

Cariboo—(Mr. Bowron's Report).

Gold.

Cariboo placer mining.

Placer deposits.—"It will be satisfactory to observe that, while a large number of miners have been engaged during the season in constructing ditches and other non-productive work, the returns show an increase in the gold product over that of last year; and in taking a comprehensive view of the operations throughout the district, there is abundant evidence to inspire confidence in the future.

"As in all enterprises of an experimental character, the introduction of new appliances in works of unusual magnitude, is frequently accompanied by disappointment, inasmuch as unforeseen obstacles arise which have not been provided for by the projectors; hence a longer period of time is often required to place a claim on a paying basis than was at first estimated. These remarks apply to a large number of enterprises in the district, among which might be mentioned the hydraulic claims now being opened on the South Fork of the Quesnel river. The owners of these claims have every evidence of the value of their property, as developments made this season further prove the correctness of their previous opinion, but they were disappointed in not getting their appliances in position so as to have had a 'wash up.' Next season, however, two companies, at least, viz., the South Fork Company and the Victoria Hydraulic Company, will undoubtedly contribute their quota to the general output of the district, as their pipes will be in position, and they will be able to commence operations as soon as the spring opens. The absorption by these two companies of a considerable amount of the available labour of that section has had the effect of reducing the output of Keithley division.

"The *Barkerville division* shows a material increase in its output, and there are at the same time several enterprises in various stages of development, which are not yet productive.

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"The *Slough Creek Mining Co.*, using the hydraulic jetting process of boring, after sinking several holes, finally succeeded in locating the deep channel at 245 feet. The pipes used by this company varied from three and a half to six inches in diameter, the smaller pipe being used as greater depth was obtained. While using the larger pipe, the value of the ground was in a measure tested, but when it became necessary to use the smaller pipe it was impossible to do so. Upon satisfying himself that the deepest part of the channel had been reached, the manager, Mr. Chas. Ramos, at once engaged a force of men, who are now sinking a working shaft, which is at present about thirty feet down.

"Considering the extent of undeveloped ground in Cariboo, similarly situated to that of the valley of Slough creek, such as Williams creek meadows, Willow river, Lower Lightning creek, Lower Antler creek, Bear river, and many other streams, known to have deep channels, which have never been exploited, we are impressed with the fact that the boring machine will become an important factor in the development of the district. In using such means to prospect deep ground, it would be advisable that a larger hole be bored, so that the value of the gravel on the bottom might be tested without the great expense of sinking a working shaft.

"The *Nason Co.*, of Antler creek, having purchased a steam pump and placed it in position, are now starting again to pump out their diggings, and with this addition to their former pumping machinery, the company will doubtless be able to keep the water out, and so finally determine the value of their claim.

"The *Waverley Co.*, of Grouse creek, continue to improve their output, although the shareholders have been somewhat disappointed that the claim did not pay expenses this season.

"The *Clear Grit Co.*, of Canadian creek, have discovered what they suppose to be a large river channel, entirely independent of present watercourses, and parallel to that in which they have been working with varying success for the past twenty years. The new found channel, which is about forty feet to the west of the old channel, contains paying gravel thirty feet in depth, but the width is not yet ascertained.

"Mr. George Ferguson has formed a company, and is now sinking in the hill on the ground adjoining. Should he succeed in finding similar pay gravel to that discovered in the Clear Grit ground, he considers the find of more importance than the discovery of Williams creek.

"The only discovery made in the district this season, which may be regarded as entirely new, was that of Mr. E. C. Shepherd and partner

on a small stream which flows into Antler creek, and is now known as *Shepherd creek*. The discovery was made near the source of the creek in Downie pass, two and a half miles east of Williams creek meadows. As the gold is of a coarse character and well washed, hopes are entertained that the discovery may lead to something of importance.

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Discovery and
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"The *Forest Rose* claim, of Williams creek, continues to maintain its reputation of being one of the most productive in the district.

"The accompanying statistics also show that the placer mines on *Mosquito creek* have somewhat exceeded the usual output.

"The company which obtained a concession of one mile of the valley of *Willow river* have not as yet commenced operations; but, I learn, have recently interested English capitalists in their enterprise, and expect shortly to proceed with the work. This is one of the most promising enterprises ever offered to capital as a mining investment.

"Mr. Whittier, who obtained a lease of ground on the meadows of *Williams creek* has apparently failed to induce London capitalists to take hold of his undertaking.

"The *Lightning creek division* shows quite a falling off in the product of its mines. A company, which applied for and obtained a lease of a portion of the old *South Wales* ground, have been working continuously for the past two years, endeavouring to find benches upon which auriferous gravel was supposed to exist, have at last been rewarded and are now taking out fairly good pay. This company will continue working during the winter.

"The *Big Bonanza* claim, prospecting the deep ground on *Lower Lightning creek*, were unfortunate in having a portion of their dam washed away during the spring freshet. A contract to repair the break is now let, upon completion of which the company will pump out their diggings and resume work underground.

"In the *Quesnel division* there has been a slight decrease in the gold product. The *Blue Lead Company*, of Hixon creek, although continuing operations during the season, have not as yet succeeded in developing pay in the hill channel.

"Another branch of our mining industry, and one which hitherto seems to have been quite overlooked, or at least has attracted but little attention, is destined in the near future to add much to our resources. I refer to the gravel bars in our rivers and large creeks. In 1891 a Mr. L. Sampson visited Cariboo, claiming to be the patentee of a gold saving apparatus, which being immersed in the bottom of a stream caught every particle of gold passing over it. Although having the plant with him, and spending much time in examining various streams

for the purpose, Mr. Sampson gave no practical test of his ability to do what he claimed. He again visited Cariboo in the spring of 1892, and applied for a concession on certain streams, but suddenly left the district again without making a trial. His advent among us has had the effect, however, of directing the attention of some of our old miners and practical men to the fact that the gravel bars in our rivers, which are now worked exclusively by Chinese during low water by means of the old-fashioned rocker, may, by the appliance of proper machinery, be made to yield thousands where now but dollars are produced.

"Chinamen have been known to work over the same surface ten years in succession with profit, fresh deposits of auriferous sand and gravel being washed down during each year's high water.

"A few persons of undoubted mechanical invention, associated with old Fraser River miners, adepts at saving fine gold, have the matter in hand, with every prospect of producing machinery which will cause the working of these bars to become a profitable investment for capital.

"A large number of mining leases have been applied for during the year, mostly by non-residents. I regret to say, many of the applicants, after obtaining the option, have failed to complete their title. I would, therefore, suggest that applicants for leases be required to make a deposit of the amount of rent proposed to be paid for the first year, upon filing their application with the gold commissioner, the same to be forfeited in case of failure to complete their title.

"Mr. Hobson, one of California's most skilled and experienced placer miners, visited the district this summer, and expressed much surprise at observing the almost unlimited extent of what he regards as auriferous gravel, which, worked with the modern and approved appliances now in use in California, must, he believes, contribute greatly to the wealth of the province. But he is of the opinion that railway connection—providing cheaper labour, cheaper supplies, and cheaper transportation—will be essential to carry on the work on a sufficiently large scale to ensure paying investments.

Cariboo
quartz mining.

Quartz.—"Our quartz mines, which, for the past three years, have not received the attention which their importance would seem to merit, attracted some little notice recently, in consequence of a visit of Mr. A. J. Colquhoun, a representative of the Gold and Silver Recovery Syndicate of Glasgow, Scotland. This company are the patentees of what is known as the McArthur-Forest process of treating refractory ores, which entirely does away with the expense of roasting, which forms a part of all other known processes. The successful working of 300 pounds of ore from the Black Jack, and a similar amount from the Island Mountain mine, sent to Glasgow about two years ago, induced

this company to send Mr. Colquhoun to Cariboo, who, before leaving here, bonded a number of mineral claims. That gentleman informed us that his company will probable erect a plant for the reduction of ore in Cariboo next season; and after visiting the government reduction works, stated that the chlorinating plant there could be easily utilized in working his process.

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Discovery and
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Gold.

"The *Black Jack* is the only company which has done anything worthy of mention in the way of mineral development during the past season. This company baled out their shaft to the 64-foot level, and commenced taking out and milling ore with their one stamp mill. The concentrates were sent to the reduction works for treatment, but after producing a small \$425 gold bar, it was found that, with their present crude manner of working, the claim could not be made to pay; and therefore the works were shut down. I am informed by the secretary of the company that it cost over \$50 per ton to mine and mill the ore worked, which under favourable circumstances should not exceed one-fourth that sum. This is but one instance, in perhaps hundreds in Cariboo, where valuable mining properties lie unworked or undeveloped, awaiting railway construction to render them profitable investments.

"I estimate the gold product of the district for the year (exclusive of Omineca) will exceed \$200,000, basing such conclusion upon the following actual and approximate figures:—

Barkerville	Division, to 15th Nov., 1892..	\$76,600
Lightning Creek	" " ..	41,500
Quesnellemouth	" " ..	23,500
Keithley Creek	" " ..	52,400
Estimated output, from 15th Nov. to 31st Dec..		10,000

\$204,000

Mr. Stephenson's report of the Keithley, Alexandria, and Williams Lake polling divisions of the Cariboo district:

Keithley,
Alexandria,
Williams
Lake.

"The season has been favourable for mining operations all through this section of Cariboo, as the water supply held out well during the season; still the estimated amount of gold falls short of last year, which I think is owing to a steadily decreasing mining population, especially as regards Chinese miners. The reason for which is, that they, the Chinese, have pretty well worked out the shallow benches and small streams where gold was easily obtained, often by the individual miner, and always by small companies of from four to eight men, who by doing their own labour, could at a small outlay for material, open such claims by one season's work. Such claims of course were

soon worked out ; but it is mining of this nature that the Chinese engage in, and now that the opportunity for such mining is growing less the Chinese are leaving this part of Cariboo. But this does not mean that mining is generally finished in this section, as, I believe, we are only just beginning to find out that we have plenty of good mining ground in hill channels along the Quesnel, and both on the South and North Forks of this river ; also, on other streams in this vicinity. With the continuance of work now being carried on by three different companies, another season will probably see the development of some of the claims, if not of all three ; then, should the results be satisfactory, capital will be easily found for other works of the same kind.

"The result of mining operations on the *Snowshoe creek* has not answered expectations. The *Golden Gate Company*, which went to a heavy expense to sink a shaft in bed-rock near the lower end of the creek, effected their object, and drove into the deep ground ; at times very good prospects were met with, but upon the whole, the return has not proved satisfactory to the owners. The two hydraulic claims up near the head of the creek have paid in excess of expenses for the season, but the dividends were lighter than usual ; while the company of Chinese working their claim by an open cut in the bed of the creek, will not admit that they are making much, still they seem quite satisfied with what they are getting.

"On *Keithley creek*, three out of the four hydraulic claims working have done fairly well, while the fourth has not yet reached ground where they expect to find pay. The creek claims which are worked by open cuts in the bed of the creek, have not done very well, as the unusually high stage of water in the creek has caused trouble in the endeavour to keep the wing-dams in good condition. On the *North Fork of Quesnel river* there is not much doing, beyond desultory mining ; one white miner still continues to drive a tunnel into the hill, looking for a back channel, but it is slow work, single handed. The company of whites on *Spanish creek* still keep on with their work, drifting up stream and into the hill ; they have mined a little gold with prospects of better pay ahead.

"The two Chinese hydraulic companies on the *South Fork of the Quesnel river*, have made about an average season's work, while some desultory mining has also been going on as usual. Both the *Victoria* and *South Fork Hydraulic Mining Companies* have been pushing their work ahead as fast as possible ; the former with an average gang of eight white men on the claim and about twenty-five Chinamen on ditch work, by contract ; the latter, with ten white men on the claim, and about twenty-five Chinese on ditch work, by contract ; and

still there is work to be done by both companies before any returns can be looked for.

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"The *Horsefly* section is again receiving attention, and it is likely that there will be quite a number of men working there the coming season, as a company of capitalists have obtained the *Discovery Company's ground*, with their water right and other privileges; they are also about obtaining some ground by lease adjoining the Discovery Company's ground. Although the expense of bringing on a good supply of water will be heavy, still there is every reason to believe that with plenty of water the ground will pay for hydraulic mining. The company is working a gang of ten men during the winter to thoroughly prospect the ground before going to the expense of bringing on water. The *Harper claim* (lease), on *Horsefly*, has done very little during the season, as the *Horsefly* river has kept very high nearly all the season, which was very much against the working of the ground, in fact, making it almost impossible, owing to the nature of the work to be done.

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"Along the *Fraser river*, the regularly organized companies that have water for hydraulic mining, have done about the usual amount of work, while the desultory mining has been less than that of last season.

Cassiar—(Mr. Porter's Report).

Cassiar.

"The returns for the present season, as will be observed, show a considerable falling off in the yield of gold when compared with last year.

"During the season some sixteen miners, who would have been working on *Dease* or *Thibert creeks*, and taking out gold, were employed by a mining company from California that acquired leases of mining ground on *Thibert creek*, and have been during the summer engaged building a ditch and doing other work pertaining to their claims.

"A rumour of the existence of rich ore on the *Hyland river* and its tributaries induced certain miners to visit that section of country. On their return they reported the discovery of a ledge, and duly recorded a claim under the "Mineral Act," with the intention of thoroughly testing the same next spring.

"The mining carried on now in the old creeks is chiefly by Chinese, who keep working the old claims over, some of which have been worked many times.

"One or two tunnel claims on *Thibert creek* are doing fairly well.

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"The mining prosecuted both on the *Stickeen* and *Liard* rivers, with one or two exceptions, is chiefly on the bars below high water mark, and of a desultory nature.

"As closely as can be estimated, the number of miners and others in the district this year, exclusive of Indians, amounted to about 120, of these sixty-five were Chinese.

"The following returns are as correct as it is possible to have them, owing to the many difficulties in the way of obtaining accurate information :

Dease creek.....	\$ 8,700
Thibert creek.....	6,500
McDame's creek.....	9,200
Liard river.....	3,600
Stickeen river.....	950
Total.....	\$28,950

"Next year it is generally expected that our population will exceed the present, and the returns, it is confidently believed, cannot be less than the figures given above.

*Gold and Silver.*West Kootenay.
Revelstoke.*West Kootenay—(Mr. Fitzstubb's Report).**Revelstoke Division.*

"*Lardeau District.*—In this district there have been seventy-one mineral locations recorded during the present year, and seven transfers of interest in claims. Assessment work will be done on the majority of the locations taken up, and the work recorded during the twelve-month limit. This division shows signs of becoming a very rich one, the lowest assay of ore taken from various claims being forty ounces in silver, and ranging as high as 200 ounces, and in some cases showing a good percentage of gold.

"*Big Bend District.*—Very little prospecting has been done in this district, only four claims having been recorded during the present year, and on those no work has yet been recorded. There is a little placer mining going on, and I am informed that in this enterprise about eight men are steadily employed.

Illecillewaet.

Illecillewaet Division.

"In this district ninety-eight claims have been recorded, on the greater part of which assessment work will be done. Forty transfers and agreements for sale have also been filed, amounting to over \$47,000. Between \$25,000 and \$30,000 have been expended in development work during the current year.

Slocan Division.

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"In this district, during the current year, 750 locations have been recorded, on the greater part of which assessment work will be duly recorded.

"Three hundred and forty transfers and bills of sale have also been recorded, aggregating \$550,000, and it is estimated that the sum of \$201,000 in cash has changed hands by reason of transfers up to date.

Gold and
Silver.
Slocan.

"To illustrate the activity in mining in this district, the following statistics, which have been kindly furnished by Mr. J. L. Retallack (whose accuracy and sources of information may be safely relied upon), may be of interest:—

"On the *Noble Five* group of claims, situated on Carpenter creek, the sum of \$6,000 has been expended, principally in driving a tunnel 150 feet, and a trail seven miles long. Only samples of ore have been shipped from this camp, but a large body of ore has been exposed.

"On the *Slocan Star* claims, situated on Sandon creek, development work, consisting of 180 feet of tunnelling has been done, and a trail of two miles has been built. Extensive machinery will be put on this group during the spring, when the output is expected to reach 300 tons of concentrates per month.

"On the *Payne* group of claims, situated on Carpenter creek, upwards of \$4,000 have been expended in development work and trails. No ore has been shipped at present.

"On the *Blue Bird* claim upwards of \$10,000 have been expended on 600 feet of tunnelling, and also six miles of trail. One hundred tons of ore from this mine have been shipped via the Kaslo wagon road.

"On the *Freddy Lee*, situated on Cody creek, upwards of \$20,000 have been expended in development work, and \$4,500 on trails, etc. Over 400 tons of ore have been shipped from this mine.

"On the *Washington*, situated on Carpenter creek, 200 feet of tunnels have been driven, and good mountain trails have been built. It is estimated that 1,500 tons of ore will be shipped from this claim during the present winter.

"On the *Dardanelles* group, situated on McGuigan creek, about \$4,500 have been expended on development work, and a trail four miles long has been built. About ten tons of ore have been shipped from this camp, showing satisfactory returns.

"On the *Best* claim, situated adjacent to the Dardanelles, over \$10,000 have been expended on development work, and a trail three miles long has been built. About fifteen tons of ore have been shipped from this claim.

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"On the *Idaho* claim, situated between Four-Mile creek and Hansen creek, about \$2,400 have been expended on development work, and a trail, costing about \$1,000, has also been built. About fifteen tons of ore have been shipped from this claim.

"On the *Great Western* group, situated about one mile east of the Washington, 200 feet of tunnels have been driven, and three miles of trail have been built. No ore has been shipped from this group.

"On the *Queen Bess*, situated on Cody creek, the sum of \$5,000 is at present being expended on development work, and a trail, costing \$500, has been built. No ore has been shipped from this claim.

"On the *Lucky Jim* and *Roadley* group, situated on Seaton creek, about \$10,000 have been expended on development work and trails. No ore has been shipped from this group.

"Of other claims in this district, on which considerable development work has been done, may be mentioned :—

"The *Northern Belle*, on Jackson creek. This claim has been bonded for \$45,000.

"The *Slocan Boy*, adjoining the Washington. On this claim there is a large quantity of ore in sight.

"The *Reco* and *Wonderful*, situated between the Noble Five and Blue Bird. There is a large amount of ore in sight on these claims. Thirteen men are steadily employed developing.

"The *Silver Glance* group, situated two miles north-west from the town of Watson. Development work has been going on all summer, and the claims have been bonded for \$45,000.

"The *Sunset* claim, near the Blue Bird, has been bonded for \$20,000.

"The *R. E. Lee*, situated about three-quarters of a mile south of the Washington, has been bonded for \$20,000.

"The *Chambers* group, situated on Cody creek, has been bonded for \$50,000.

"The *Big Bertha*, an extension of the Dardanelles, has been bonded for \$45,000

"The *Utica*, on the same creek, has been bonded for \$30,000.

Ainsworth.

Ainsworth Division.

"During the current year in this district there have been 470 mining claims recorded, and 274 transfers have been filed. Of the 470 claims recorded, assessment work will be done on the greater part.

"Immediately in the vicinity of Ainsworth, rich strikes have been made, among which may notably be mentioned the *Mile Point* claim, assaying as high as 400 ounces in silver per ton.

"On the *Skyline* silver claim it is the intention of the owners to erect a stamp mill during the coming spring.

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"On the *Highlander* claim considerable development work has been done.

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"On the *Lady of the Lake* group of claims, it is estimated that \$25,000 will be expended during the coming season on development work and general improvements.

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Silver.

"*Kaslo portion*.—On the *Solo* group, situated on Lyle creek, extensive development work has been done, and good trails built. There is a large body of ore in sight.

"On the *Wellington* claim, situated on Whitewater creek, steady work has been done, exposing large bodies of ore. It is the intention of the owners to put extensive machinery on this property in the spring. Ten tons of ore have been shipped from this mine, showing good returns.

"On the claims of the *Brennand* group, situated on Lyle creek, about \$2,000 have been expended on development work and a good trail has been made.

"On the *Whitewater* claim, situated on Whitewater creek, about \$2,500 have been expended on development work. About eight tons of ore have been shipped from this claim.

"The *Beaver* group of claims, situated fifteen miles north of Kaslo, have been bonded for \$75,000.

"On the *Montesuma* and *Mexico* claims about \$3,000 have been expended in getting in supplies and erecting buildings preparatory to developing the property, which is now bonded for the sum of \$20,000.

"The *Twilight*, situated on Twelve-Mile creek, has been bonded for the sum of \$20,000.

"The *Fourth of July* and *Viola* claims, situated on Spring creek, have been bonded for the sum of \$50,000.

"The *Yosemite*, *Homestake* and *Eureka*, in the Brennand camp, have been bonded for the sum of \$65,000.

"The aggregate sum of the above, and bonds given for smaller amounts on other claims, amount to nearly \$334,000.

"A wagon road has been built from Kaslo to Bear Lake by private subscription, costing in the neighbourhood of \$20,000.

"*Lardeau and Duncan portions*.—Late in the season several good prospects were discovered, assays ranging very high, and on the Duncan slope, near Upper Kootenay lake, a gold strike has been made, showing free milling ore, assays of which have been made as high as \$1,000 per ton.

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Pilot bay.

"Good placer ground has been reported on the bars of the Duncan river. It is expected that a big rush will be made into this part of the district during the coming summer.

"On *La France creek* about fifty locations have been made. The ledges are very strong, being composed chiefly of galena and copper, with a fair percentage of gold.

"On *Pilot bay, Kootenay lake*, a smelter is in the course of construction, attached to which will be a refinery. It is estimated that the cost of these extensive works (which will be completed early next summer) will be not less than \$250,000.

"The buildings are built of brick, and roofed with corrugated iron.

"The following dimensions of the buildings may be of interest:—

Concentrator building.....	85x100
Sampling works.....	100x108
Roaster.....	100x170
Smelter.....	58x 98
Refinery.....	120x245
Assay office.....	20x 80
Boiler house.....	40x 48
Blacksmith shop.....	20x 40
Machine shop.....	20x 40
Office.....	30x 45
Boarding house.....	25x 60

Goat River. *Goat River Division.*

"Several claims have been taken up and recorded, and assessment work done on most of them.

"The quality of the ore assayed from this district is good, being composed of galena, copper, and a percentage of gold. It promises to be a rich district.

Trail Creek. *Trail Creek Division.*

"In this district sixty-seven mining claims have been recorded, and eighty-eight transfers and bills of sale filed. Assessment work will be done on nearly all claims taken up.

"The principal claims are as follows:—

"The *Le Roi* and *Centre Star*. On these claims work has been prosecuted continuously, and development work has exposed large bodies of ore. The ore assays \$40 in gold, four ounces in silver, and eight per cent copper per ton.

"On the *O. K.* claim a fair amount of work has been done, showing up a large body of ore, composed of iron pyrites and galena, assays varying from \$200 per ton upwards.

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"Twelve miles of wagon road from the *Le Roi* mine, the centre of the *Trail* creek group, have, by private subscription, been built to the international boundary. Over this road \$4,000 worth of ore has been taken from the *O. K.* mine, and supplies shipped in. A refund of \$2,025, the cost of this undertaking, is asked.

"On the *Pend Oreille* river valuable placer ground has been discovered. It is estimated that \$50,000 is being expended on this river in building saw-mills, ditches, etc., so as to work this ground on a very large scale.

Nelson Division.

Nelson.

"In this district 244 locations have been recorded, and 197 transfers filed. On the majority of locations assessment work will be done and recorded in due course. To illustrate the mining enterprise in this division, the following may suffice:—

"On the *Whitewater* and *Snow-water* gold claims, situated on *Rover* creek, tunnels to further develop the properties have been driven. Work on the latter is being prosecuted all the present winter.

"On the *Poorman* gold mine, situated on *Eagle* creek, there has been a large amount of work done. This mine has a ten-stamp mill on it, and it is estimated that \$10,000 has been taken out of this mine in free gold during the last summer.

"On the *Silver King* mine, situated on *Toad* mountain, the main tunnel has been extended 150 feet, and other development work, aggregating 912 feet. This mine stands at the head of all discoveries so far made in *West Kootenay*, and is now bonded to a *Scotch* syndicate for nearly \$2,000,000.

"On the *Grizzly Bear* claim, situated on the same mountain, about \$14,000 have been expended on development work. No ore has been shipped.

"On the *Silver Queen*, adjacent to the *Silver King* mine, \$9,000 have been expended during the past summer.

"On the *Dandy* mine, also adjacent to the *Silver King*, a large amount of development has been done, and large bodies of ore exposed. The *Dandy*, as regards value, ranks next to the *Silver King*.

"On *Morning mountain* several claims have been located, and show great promise of future richness.

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"On Mineral mountain, the *Lizzie C.* claim shows a great deal of development, but no ore has as yet been shipped from this claim.

"Between Mineral and Toad mountains several good gold claims have been discovered, showing returns of 40 per cent copper, and \$30 in gold per ton.

"*Placer Claims.*—The following records have been made:—

Locations.....	15
Transfers.....	8
Leases.....	4

"On *Forty-Nine creek* some very good ground is being worked.

"On *Hall creek*, about twelve miles south of the town of Nelson, good prospects have been found, yielding from \$4 to \$8 per day to the man.

"On this creek also a strong ledge of-gold-bearing quartz has been discovered, showing returns of \$10 to \$30 per ton.

"On *Salmon river* extremely good prospects have been found, and leases have been granted to parties who intend working their properties on a large scale next summer.

"Owing to the very rich finds in the Slocan district, prospectors have been naturally attracted to that part of the country, who would otherwise have stayed round Nelson and further prospected and developed claims in the immediate vicinity, and this also applies to other recording divisions outside of Slocan.

"The following is a recapitulation of claims, etc., taken up in West Kootenay district during the current year:—

	Claims Recorded.	Transfers Recorded.
Revelstoke.....	75	7
Illecillewaet.....	98	40
Slocan.....	750	340
Ainsworth.....	470	274
Goat river.....	No report.	
Trail creek.....	67	88
Nelson.....	244	197
Totals.....	1,704	946

East Kootenay—(Mr. Cummins's Report.)

"*Placer Mining.*—The accompanying statement shows the estimated yield of placer gold from the various creeks to be as follows:—

Wild Horse creek.....	\$25,000
Perry creek.....	3,000
Moyie river.....	1,500
Weaver creek.....	200

Total..... \$29,700

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being an advance of \$12,000 on the production of last year. It should be stated that owing to the unusually early advent of winter, one of the Chinese companies on Wild Horse creek did not finish cleaning up. Mr. Griffith's hydraulic property has also been unworked during the summer, pending negotiations for a transfer to an English company, which are now understood to have been satisfactorily concluded. The company is entitled *The East Kootenay Exploration Syndicate, Ltd.*, of London. Mr. McVittie, the manager, informs me that his company has purchased and will put in next spring an additional pipe line, fourteen inches diameter, which, with the pipe already in position will enable him to use three giants. The property consists of 2,100 feet of patented ground and 1,700 feet of recorded ground, all bench claims. The company holds 1,900 inches of water, with a working head of over 300 feet.

"The operations being carried on to test the deep ground on *Wild Horse creek*, about eight miles from its mouth, alluded to in last year's report, met with a check, owing to trouble experienced in dealing with the surface water. It has, however, been determined to continue operations by sinking a shaft in a more favourable situation. The company built a road about three miles in length last summer, to enable them to bring in pumping machinery.

"About two miles from the mouth of the creek, where it leaves the foot-hills, Mr. M. Phillips, of Fort Steele, and associates, is sinking a shaft to reach the bed-rock. The shaft is being sunk in the rim rock, with the idea, I presume, of avoiding surface water. It is the intention to drift across the channel when sufficient depth has been reached. This ground is being worked at present under record as an ordinary claim. A lease has, however, been applied for.

"Some excitement was caused during the early part of the season by the discovery of deposits of black sand on the *St. Mary's river*, near the St. Eugène mission. Samples of the sands on being assayed gave results as high as \$4,000 gold to the ton of black sand. I am not in a posi-

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tion to state if the sands underwent concentration by panning before the samples were selected. I assume that the gold was principally placer gold in the free state. It is, however, contended that the magnetic oxide of iron (black sand) in itself also contained a considerable quantity of gold.* The discoverers are satisfied that with modern gold saving plant these sands can be profitably worked, and four leases have been applied for. It is stated that large deposits of black sand also exist on *Gold creek*, which runs into the Kootenay river about five miles north of the international boundary.

"To the north of *Donald* some promising placer prospects have been reported to have been found late in the season, and a number of applications for leases have been made on the *Blue Water river*. I am not in a position to report on the importance of these discoveries. The discoverers claim in each case to have obtained good prospects.

"The intended hydraulic operations on *Quartz creek* were stopped by an injunction of the Supreme Court, forbidding the company from turning their tailings into the creek, to the prejudice of the interests of the Columbia Lumber Company.

Quartz mining *Quartz Mining.*

"Prospecting for quartz leads has, during the past season, not been as active as could have been desired, especially in the northern portion of the district. The southern portion has received more attention, with some most important results, a number of new discoveries having been made in the Fort Steele recording division of the district. The most important of these is the '*North Star*' claim, situated on the St. Mary's river, about twenty miles' travel from Fort Steele, a more particular description of which will be found further on.

"Mining operations in the McMurdo district have been confined to the Vermont creek locality and to the neighbourhood of the "Bobby Burns Basin," on the left bank of the Middle Fork of the Spillemechene river, whilst the most important and extensive work has been in progress on the Thunder Hill Mining Company's property on Thunder hill, near the Columbia lake, both as regards development of the property and its exploitation as a mine.

"A very handsome and representative collection of minerals, considering the stage of mining development in the district, has been collected to be forwarded to the World's Fair, Chicago.

*The following analysis of a sample of the black sand may be of interest: Iron 52 per cent; oxygen, 21.80 per cent; silver and gold, 0.75 per cent; lead, 3.50 per cent; insoluble, 21 per cent. The gold was in the form of brilla, or colours.

"*McMurdo District*.—The '*Bobby Burns*' claim. It is to be regretted that the expectations of an immediate output, looked forward to this season, have not yet been realized with respect to this property. There is, however, not any reason to retract the favourable notice in last year's report, as to the probable paying qualities of the claim, under competent and experienced management. A road has been built for a distance of about three-quarters of a mile from the mine to the five stamp mill. About thirty tons of rock were crushed, and a considerably larger quantity taken out. From some accidental cause, apparently in connection with the working of the mill, the quantity of gold saved does not seem to have realized expectations, nor corresponded with the samplings of the ore. It is stated that since the shutting down of the mill, negotiations have been on foot for the sale of the property.

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"There are several promising gold quartz claims, similar in character to the '*Bobby Burns*,' in the immediate vicinity; notably, the *International*, formerly known as the '*Chief of the Selkirks*,' the *Flying Dutchman* claim, and others. The ore in these leads is free milling, as far as seen on the surface. Where depth has been reached, sulphurets become more abundant. With the recent advances which have been made in the treatment of gold ores under these conditions, this locality should contain some valuable gold properties. Many things point to the existence of a gold belt, of as yet unknown extent, in the neighbourhood of the backbone of the range, of which these outcrops are a part. The formation in which the claims lie may be stated to consist mainly of chlorite slates and schists, the latter assuming in many cases such a granular form as to be characterized locally as granites.

"*Carbonate Mountain and Cariboo Basin*.—Nothing but assessment work has been done on Carbonate mountain this season. Crown grants have been applied for in respect of four claims owned by Messrs. Rand Bros'. Syndicate.

"In *Cariboo basin*, an aggregate of 350 feet of tunnelling has been done, in various places. It is to be regretted that this work could not have been done in one place, and one of the leads thereby tested. One of the most promising claims at the present time in this locality is the *Ellen D*. The development work has exposed a vein from three to four feet in width, well mineralized with galena, gray copper, and iron sulphurets. Assays of 1,755 ounces in silver and about \$20 in gold have been obtained.

"Only assessment work has been done on *Copper creek*.

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" *Vermont Creek*.—A tunnel has been run on the claims bonded by the *Golden Smelting Company*, on the north side of this creek. I am informed that it is intended to cross-cut to the right to reach the lead.

"The *Vermont* claim, on the southern side of *Vermont creek* (mentioned on page 568 of last year's report), which was bonded to Mr. H. C. Hammond last year, has been released by him. The owners, on resuming possession, took out a car-load of ore, which they shipped to Tacoma smelter, in September last, as a practical test of their ore, with the intention of making larger shipments during the coming season*.

"The result, as evidenced by the statement in foot-note, must be considered to be very satisfactory, considering that the ore was packed for a distance of twenty-one miles on horses, and that the charges for freight and duty were so high, the facilities for local treatment not having yet been in operation. With respect to the cost of mining, it may be mentioned that the ore was taken out of tunnels at a low depth, with a view to development, leaving the ore above to be stoped out in the future at much smaller expense.

"No development work of importance has been done on the creeks between the *South Fork of the Spillemechene* and *Toby creek*, though, as mentioned in former reports, promising prospects exist in this region.

"*Jubilee and Spillemechene Mountain*.—There is no important progress to be reported regarding the claims on *Jubilee mountain*. Some very fine specimens of copper ore were contributed from this mountain to the World's Fair collection.

"Work was again resumed on the large lead on *Spillemechene mountain*, a tunnel about 150 feet in length being driven on the lowest point on the lead at which any work has yet been done. It is supposed that the tunnel will have to go some distance further before ore is reached, at this point.

*Cost of mining 20 $\frac{3}{4}$ tons of ore	\$ 492 00
Packing to Columbia river	\$615 00
Freight by steamboat to Golden	31 15
Freight to Tacoma	177 20
Duty	368 81
Sacks	31 00
	1,212 66
	\$1,704 66

Net returns from smelter	\$2,060 87
Total cost	1,704 66
Profit	\$ 356 21

Lead quoted at \$3.80; silver, 84 $\frac{1}{2}$ cents.

"*Thunder Hill*.—As stated above, work has been active this summer on and in connection with the *Thunder Hill mine*. Two Ingersoll steam drills have been in use, which have worked to great advantage. Large quantities of concentrating ore have been taken out and stored in the bins, ready to be transported to the concentrating works on the shore of the Columbia lake, a distance of about one and three-quarter mile, as soon as the erecting of the machinery is completed and the tramway leading from the mine to the works in running order. The concentrating plant, manufactured by the Chicago Iron Works Company, is of a capacity of fifty tons a day.

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"The ore passes from the crushers to the rolls, then to the screens, and descending to the jigs. The concentrates resulting from this treatment are here withdrawn, whilst the slimes undergo fine concentration on double revolving buddles or slime tables of approved type. The buildings are roomy and substantial, everything being laid out in a most convenient yet compact manner. I understand that the works will be in running order about June next. The tramway is on a descending grade from the mine, and will be worked by gravity in bringing down the ore; whilst for the present the trucks will be returned to the mine by horse power. The immense bodies of quartz which are exposed by the workings at the mine, are of increasing size as greater depth is attained, and would appear to be more heavily mineralized. Several careful samplings of the ore body thus far exposed have been made during the past summer, as the work progressed, which are stated to have furnished favourable results.

"It is understood that the company contemplates working the mine on a much larger scale, with a 250-ton plant, when the present plant shall have proved itself an established success in dealing with the ores from the mine.

"A force of about forty-five men has been engaged in connection with this mine during the past season.

"It is hardly necessary to point out the vast importance of this undertaking, and the results which would follow its success, when it is stated that the lead extends for several miles and is covered by claims owned by this company and others, and that there are many outcrops on it, which are stated to be similar on the surface to those on the Thunder hill claim.

"No important advance has been made at the Copper claims on *Windermere mountain*.

"The *Canal claim* on the east side of Columbia lake, about opposite Thunder hill, alluded to in last report as having been sold for \$3,000

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cash, has received but little work this year, the attention of the owners being taken up with their other ventures in the district.

"*Hughes Range*.—A number of discoveries have been made in the Hughes range of the Rockies, on the eastern side of the Kootenay river. A lead of large size runs along this first range, and has been traced almost continuously for about ten miles in the Cambrian slate formation, which as described in the report for 1890, crosses the valley from the Selkirk or western side of the Columbia lakes, into the Rockies, forming the front range along the eastern side of the Kootenay valley. Portions of this lead are found to be almost barren quartz, whilst in other places it is found mineralized with gray and antimonial copper ores, containing both silver and gold. A sample of gray copper from the lead near where it cuts *Rock creek*, assayed 119 oz. in silver, \$9.27 gold, and 29.45% copper.

"Claims have been staked almost continuously along this lead for over five or six miles. The lead varies in width from two feet to twenty feet. A small amount of work done on one of the claims north of *Rock creek* did not give favourable results.

"It would be premature to estimate the importance of these discoveries, as but little work has yet been done anywhere on the lead.

"*Lost Creek*.—Some work done on this creek has led to the discovery of a vein of larger size than those heretofore found on what is known as the '*Dibble*' claim. It is proposed to make a shipment early next season.

"*North Star Mine*.—During the past summer a most important discovery of an immense body of 'steel' galena was made near *St. Mary's river*, about twenty miles north-west of Fort Steele. The lode occurs on the eastern slope, near the ridge of a mountain, or butte, about 2,000 feet above the river, in the foot-hill range of the Selkirks, near the extreme western end of the *St. Mary's prairie*. The mountains in this locality show but little exposed rock, being generally covered with several feet of wash and soil, and are to a great extent timbered. The lode is covered with six or eight feet of wash material. Its trend, as evidenced by the portion which has been uncovered, and by the float and boulders of iron ore and galena on the surface, appears to be north and south. The discoverers commenced by making a cross-cut in an easterly and westerly direction, at a place where a quantity of boulders and nodules of ore lay on the surface. After sinking through six or eight feet of wash material and decomposed mineral they bared and sunk into an immense body of pure 'steel' galena, showing no gangue whatever, and being perfectly solid, without the

least sign of cracks or displacement, measuring twenty-three feet across, no distinct wall being discoverable at this stage. On the eastern side, decomposed lead matter is found, seven or eight feet in width, consisting of lead carbonates, iron and antimony, making the total width of the lead, or deposit, about thirty feet at this place. Since the date of my examination of the discovery, I am informed that a shaft, thirty-six feet in depth, has been sunk in the soft portion of the lead mentioned above, and to that depth no change in character of the ore body had taken place; the wall, found to be the foot wall, was more defined, and was dipping to the west. The hanging wall has, apparently, not yet been uncovered. The country rock, where cropping to the east of the lead, is siliceous in character, carrying little if any carbonate of lime, and would probably be termed quartzite. The foot wall of the lead where recently bared in the shaft is, however, stated to be limestone. It is also stated that outcrops of granitic dykes exist to the west of the lead. I did not, however, see any of the outcrops, nor would the greenstone float, found in the locality, appear to be of local origin. Iron outcrops occur at various places on the mountain, which may possibly be cap-pings to deposits of galena.

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"A sampling of the galena body, taken from the open cut, gave the following assay results: Silver, 47.31 oz.; gold, nil lead, 67.50%; iron, 6.63%; zinc, 1.90%.

"It would be premature to make any statements as to the precise character and permanence of this lode, or in what degree the portion so far uncovered represents the permanent width.

"Towards the end of September last the discoverers, Messrs. Bourgeois and Langill, bonded the property to Messrs. Woods Bros., of Quebec, who have since transferred four-fifths of their interest to Mr. D. D. Mann, of Montreal. The bond expires on the 1st July next. The development of the property is now being prosecuted under the superintendence of Mr. Leslie Hill, M.E. I am informed that it is intended to continue sinking the present shaft to a depth of 100 feet, and to cross-cut westward to the west wall of the lead without delay.

"With regard to the future exploitation of this mine, it may be assumed that at first shipments of the ore would be made via Kootenay river and Jennings on the Great Northern railway, to smelters in the United States. It might, if favourable terms are obtained, for a time be shipped north to the smelter at Golden, as the duty would thus be saved, as a set-off against the extra freight in reaching a market. It is, however, manifest that before long, if the mine realizes expectations, it must be opened up on a very large scale, the ore being smelted on

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the spot. The natural outlet for the bullion would probably be to the States, or to the English market, shipped through the States in bond.

"Timber suitable for a supply of charcoal for smelting would be available in the locality for some years, but coke, manufactured from the Crow's Nest coal, will ultimately have to be relied on. It is a matter for congratulation that this property has, at such an early stage, got into the hands of men with sufficient capital to do it justice.

"*East Kootenay, North of the C.P.R.*—As mentioned in former reports, the portion of the district north of Donald has not yet received much attention from the prospector, owing principally to difficulty of access, from want of practicable trails beyond Bush river.

"There are no new developments to report from the Ottertail and Field locations.

"Some trials were made at Golden by an agent of the Gold Recovery Syndicate of Glasgow, to test the suitability of the McArthur-Forrest, or cyanide, process for the extraction of the precious metals from the ores of the district. The process was found eminently successful as regards gold ores. The silver extraction was not attended with such good results. Ores containing even a small percentage of copper cannot, at present, be successfully treated by this process.

"There were 295 free miners' certificates issued, and 134 mineral claims recorded in the district during the year 1892."

Lillooet.

Lillooet (Mr. Soues's Report).

"The total yield of gold for the year (ascertained from reliable sources only) is \$39,763.

"This return, as compared with that of last year shows a decrease of upwards of \$12,000.

"I regret that I have to report the mining industry during the year at lower ebb than any time during the past decade. Miners—principally Chinese—have deserted the district; there have not been any new discoveries, and prospecting has been entirely neglected.

"Mr. Phair, Mining Recorder at *Lillooet*, reports to me to date: "I regret to say the gold taken out of this part of the district for 1892 is about \$15,000 less than for the previous year.

"The desultory mining on the *Fraser river* by Chinese has almost ceased, and they have nearly all left the district.

"The *Vancouver Company*, on Cayoosh creek, have completed their tunnel for hydraulic mining, costing \$25,000, and will commence active work as soon as the season opens.

"The *Lilloet Hydraulic Mining Company's* claim, employing five men, has yielded about the same as the previous year, viz., \$6,000. This company have again had the misfortune of losing their dam on the South Fork of Bridge river. It is a serious loss, the company having expended \$11,000 in its construction without the slightest benefit. They intend to replace it next year, having found excellent prospects.

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"On account of the want of water, very little mining has been done on the *North American hydraulic* claim in the past year.

"The *Victor Hydraulic Mining Company*, on Cadwallader creek, have finished their ditch and placed on the ground a good hydraulic outfit. Mr. Jensen, the manager, informed me that he worked it for about a month, and found good pay.

"The *Mina Company*, on Tyaughton creek, have worked during the season with good results.

"The work done on mineral claims on *Cayoosh creek* has been almost nil.

"Leases for hydraulic mining purposes have been issued to sixteen different parties in this district, from which, so far, there are no returns, other than those referred to by Mr. Phair.

"*Quartz*.—In this class of mining I have nothing to report. No new discoveries; no locations during the year; and, with the exception of two or three claims on the *North Thompson*, there has been practically no work done on any of the mineral claims in this district in the past year."

Yale—(*Mr. Tunstall's Report*).

Yale.

Kamloops Division.—Besides giving information relating to coal, iron, copper and mercury deposits, Mr. Tunstall furnishes the following notes as to the precious metals:—

"Four applications for leases of bench lands, situated on the west bank of *Tranquille river*, have been lately filed at this office, for a term of five years. Some good prospects were obtained on a bench forty or fifty yards from the river. The gold was found on the surface, but the lateness of the season precluded the possibility of ascertaining whether it exists in the gravel at any depth.

"On *Six-Mile creek*, a tributary of Salmon river, thirteen mineral locations have been made on an argentiferous lode, stated to be from fifty to one hundred feet wide. Little or no work has been done on any of them, and the assays indicate that the vein is of a very low grade.

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"In the reports of the mining recorders for the Similkameen and Yale divisions, you will notice the progress made in the application of hydraulic mining to the alluvial benches of the *Tulameen* and *Fraser rivers*. Operations were begun on the Tulameen last summer, but not sufficient progress was made to prove the value of the ground for the gold and platinum deposits. This next season will afford a more satisfactory and conclusive test.

"These metals were found in considerable quantities in the present bed of the river, which was mined in 1861 and succeeding years, and every indication points to their existence in the ancient channel at one time occupied by the stream.

"The number of applications granted, and still in abeyance, for leases of mining ground on the Fraser river conveys but a limited idea of the extent of country capable of being worked. This river offers a wide field for the investment of capital, assisted with good management and economy.

"Messrs. deWolf, Munro, Tatlow, and others intend to consolidate their interests, and operate their locations on a scale only equalled by the most extensive companies in California and Nevada.

"Work on the other leases will be commenced in the spring, and many localities which have been abandoned since the early days of gold mining, when the bars were mined by means of rockers and sluices, will become once more remunerative under the changed condition of affairs."

Yale division.

Yale—Yale Division—(Mr. Dodd's Report).

"The desultory mining by the Chinese in this division has declined very much, and more interest has been taken by white prospectors. Numerous placer and mineral claims have been located by capitalists of both this province and the state of Washington this year, and in some instances considerable money has been expended in development. The extensive undertaking of placer mining at Lytton has been the feature of the year; however, following is the year's record in detail.

Placer
mining.

"*Placer—Siwash Creek.*—There are three placer claims being worked, one is that of the *Siwash Creek Syndicate*, which have leased four and a half miles, from the mouth of the creek up stream. This company has expended about \$9,000 in laying a substantial bed-rock flume of about 600 feet, sluicing to a depth of twenty-two feet, with the intention of further extending their flume. Some good work has been accomplished, although pay gravel has not yet rewarded the efforts made.

"Rodney & Co. have done a great deal of sluicing this year, but without reaching bed-rock. They have laid about 400 feet of flume on their claim.

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"Roddick & Co. have sluiced considerably too, with encouraging prospects.

Gold and Silver.

"Quartz.—The assessment work done by Dunn & Co. on the Montrose and Montrose Extension has rewarded them with fair prospects in free milling ore, carrying both gold and silver.

Quartz mining.

"The Gold Queen Mining Company, composed of Whatcom capitalists has expended about \$4,000 in developing their several locations. Reports made by this company state that traces of platinum have been found. This is a quartz ledge of about twelve feet wide, and the principal work has been tunnelling and running cross-cuts, and it is now the intention of this company to erect a small Huntington quartz mill to thoroughly test their locations early in the season.

"Vautier, Stenger & Co. have done a great deal of development work, and purpose doing more.

"The Yale Mining Company have found very encouraging prospects from their claims. Assays from the rock have been made, showing gold running from \$20 to \$98 per ton.

"Placer—North Bend.—Stewart & Co., of Tacoma, have applied for two placer mining leases, with the intention of pushing work vigorously in the spring.

"Boston Bar.—Four mining leases have been applied for by parties in Ottawa and Seattle; doubtless operations will be commenced when the spring opens.

"Lytton.—The Van Winkle Bar Hydraulic Company, of Vancouver, has spent \$17,000 in labour, machinery, steel pipes, and other material in opening of their extensive placer area. It comprises about 800 acres. They have laid about 3,000 feet of steel pipes, varying from 16 to 18 inches, together with all other modern improvements, under the superintendence of Mr. J. L. Holland, an experienced Californian, highly recommended to successfully carry on the work, with every hope of making handsome returns for the shareholders in the approaching season.

"Dougherty & Co. have applied for a lease at the mouth of the Thompson river, and have sunk several prospect shafts, finding good indications of pay dirt.

"In concluding this report, I am pleased to say that my returns from free miners' certificates and mining receipts have increased from \$872.50, in 1891, to \$1,440.75, in 1892.

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"I wish also further to state that the expenditure by the government of \$500 on the trail leading to Siwash creek has been highly appreciated by the miners."

*Yale—Okanagan Division—(Mr. Lumbey's Report).*Okanagan
division.

"A very little mining has been done throughout the northern part of the district. On the east side of *Swan lake* seventeen quartz claims have been located, and six on *Harris creek*, but at present only a little prospecting has been done on them.

"*Cherry Creek*.—There are five whites and six Chinese working, the latter making about \$2 per diem. The *Cherry Creek Mining Company* have run their main tunnel a distance of 1,500 feet, but have not yet bottomed the channel.

"*Siwash Creek*.—Very little mining has been done this year, and not more than \$1,200 taken out.

"In the *Rock creek mining division* the yield of gold derived from placer mining amounted to \$5,800. The gold was taken from *Rock creek* and *Boundary creek*. The workings of the *Laura Hydraulic Company* yielded about \$1,800. The company could work only three months, owing to scarcity of water.

"*Fairview Camp*.—Work has been carried on in this camp during the past summer with more energy than formerly. English and American capital has been largely invested, and a number of claims have changed hands at prices ranging from \$3,000 to \$25,000. A five stamp quartz mill was erected by the *Rattler Company* on their mill site last winter, and tests made from the ore from a number of claims, notably, the *Brown Bear*, *Stem-winder*, *Wyn M.*, *Silver Crown*, *Morning Star*, *Wide West*, *Joe Dandy*, and *Rattler*, milled from \$8 to \$50 per ton in free gold.

"Mr. E. D. Reynolds, who represents an English syndicate, has invested largely, and has already done considerable development work on his property, and intends erecting extensive mining works at or near the mines. He has twenty hands employed, which force will be largely increased on the arrival of Mr. Attwood, engineer of the company.

"Work is being prosecuted on a number of other claims with greater energy, the possibility of disposing of them being an incentive.

"*Osoyoos*.—A number of locations have been made during the summer on the mountain about three miles west of the lake, but sufficient work has not been done to determine the value of the claims.

"*Keremeos*.—Several small, but rich, ledges have been located on *Keremeos* and *Indian creek*, the owners doing merely enough work to represent their claims.

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"*Camp McKinney*.—Nothing more than assessment work has been done in this camp during the season. Crown grants have been obtained for a number of the principal claims, and the owners are awaiting the construction of a wagon road across the mountain to *Kettle river*, when machinery can be brought into the camp and work commenced at once.

"*Boundary Creek*.—This section of country has been extensively prospected, and a number of promising locations have been recorded. At *Central camp*, Messrs. White and Palmerston have been actively engaged on their claims, and have employed on an average six men since the spring. On the *City of Paris*, they have sunk two shafts, No. 1 to a depth of fifty-five feet, at the bottom running a drift twenty-five feet on the ledge; No. 2 down twenty-five feet, and a drift of twenty-five feet. On the *Lincoln* an open cut has been run on the ledge for a distance of one hundred feet, and fifteen feet deep, also a shaft sunk fifty feet at the bottom of the cut. No. 2 shaft is down eighteen feet, with a drift at bottom of shaft of ten feet. The ore from these claims is a high grade copper sulphide, carrying gold and silver, an average of the ore from the bottom of the shaft assaying as high as \$700 to the ton.

"On the *No. 7*, *Big 4*, and *Lone Star*, the property of Messrs. Attwood, Lefevre and Schofield, a considerable amount of development has been done. The *No. 7* is bonded for \$20,000 to American capitalists.

"Mr. John Douglas, who represents a New York syndicate, has secured a number of claims in this camp, and has expended a large sum in developing. On the *New York*, a forty-foot shaft has been sunk, and a drift of eighty feet from the bottom has been run. On the *Mabel* three shafts have been sunk on the ledge, forty, twenty and eighty feet, respectively, and a number of surface cross-cuts have been run. On the *Oro* a shaft is down forty feet, and Mr. Douglas has erected on this claim a substantial dwelling house and assaying office, which is fitted with all requirements for general assaying.

"The *Spokane and Great Northern Mining Company* have a number of very promising locations in the vicinity of this camp, on which they have expended during the summer nearly \$400, and have also erected a small stamp mill at the falls on *Boundary creek*, for the purpose of testing their ore.

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"The claims further up the creek have not been developed to any extent, beyond assessment work. Some very promising prospects at *Deadwood, Greenwood* and *Summit camps* are attracting considerable attention, and if the ventures at *Central Camp* and *Boundary Falls* prove successful, I understand that capital will be forthcoming for their development.

"In the *Rock creek* mining division 312 free miners' certificates have been issued from January 1st to date, and the following records entered, viz:—

Mineral claims.....	225
Assessment certificates.....	96
Transfers.....	140
Placer claims.....	5
Transfers of placer claims.....	1

Similkameen.

Yale—Similkameen Division—(Mr. Hunter's Report.)

"The yield of gold remains about the same as last year, and the yield of platinum has decreased, principally owing to the low price offered for it.

"On *Granite creek* very little work has been done this season and consequently the yield of gold has been small.

"On *Newton creek* four men have been working and obtained good wages. A considerable number of Indians were engaged in mining on this creek.

"On *Slate creek* very little has been done, owing to the ground being deep and the want of sufficient capital.

"On *Boulder creek* one Chinese company has been working and obtained fair wages.

"On the upper portion of the *Tulameen river* five companies of Chinese have been working, but as far as I can learn they made very small wages.

"The *Tulameen Improvement and Hydraulic Company's* ground situate on this portion of the river, has been prospected this season, but with what results I am unable to learn. They obtained a lay-over in October, pending a transfer of their property to an English company.

"Considerable work has been done on the lower end of the *Tulameen river*, and good results have been obtained. The *Ah Jack Company* of four Chinese, washed up six hundred dollars in one week, and made good wages during the season.

"On the *Similkameen* mining has been brisk, but the yield was small.

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METALS.

"On *Whipsaw creek*, a tributary of the South Fork of the *Similkameen*, one company obtained a lease of one mile and a half. They have done considerable work on it, and will be ready to start sluicing early next season.

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development
in British
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"On the *Allison bench* at Princeton very little work has been done on account of the scarcity of labour.

"Considerable prospecting has been done this year in quartz, but owing to the country being so thickly covered with brush and timber the work has been slow and tedious. Quantities of float have been found, but no new discoveries have been brought under my notice so far.

"The *Victoria Copper Co.*, on Friday creek, a tributary of the South Fork of the *Similkameen* river, are still prospecting their claims. The tunnel is 142 feet.

"The *Roany* and the *Spur* mineral claims, situate on the *Tulameen* river, below Granite creek, are being opened up by the owners, but I am not in a position at present to say more about them.

"On the *Nevada* and *Bonanza Queen* mineral claims, situate on the *Tulameen*, about fifteen miles above Granite creek, the owners have satisfied themselves with merely performing the necessary work to hold their locations."

PYRITES.

PYRITES.

PRODUCTION.

Production.

According to returns received there were 59,770 tons of pyrites produced during 1892, representing a value of \$179,310. The figures for last year were 67,731 tons, valued at \$203,193, so that there was a slight falling off.

This was all used in making acid and does not include other metallic sulphurets mined in Canada, but whose sulphur contents were not utilized. As the ore carries from 36 to 40 per cent of sulphur the above mentioned pyrites would represent about 26,000 tons of that element.

EXPORTS AND IMPORTS.

Exports and imports.

An inspection of the following table will show the home market for crude sulphur with which material the sulphur ores of the country must compete :—

PYRITES.
Exports and
imports.

PYRITES.

TABLE 1.

IMPORTS: BRIMSTONE OR CRUDE SULPHUR.

Fiscal Year.	Pounds.	Value.
1880	1,775,489	\$27,401
1881	2,118,720	33,956
1882	2,375,821	40,329
1883	2,336,085	36,737
1884	2,195,735	37,463
1885	2,248,986	35,043
1886	2,922,043	43,651
1887	3,103,644	38,750
1888	2,048,812	25,318
1889	2,427,510	34,006
1890	4,440,799	44,276
1891	3,601,748	45,351
1892	4,769,759	67,095

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Quebec.

DISCOVERY AND DEVELOPMENT.

QUEBEC.

The whole of the pyrites represented by the figures given above is the product of the Capelton group of mines near Sherbrooke, which have already been spoken of under the heading of copper both in this and previous reports.

Only about 15 per cent of the above amount is utilized in Canada, the rest being shipped to acid works in the United States.

Ontario.

ONTARIO.

No pyrites deposits are at present worked in this province, but the addition made to the plant of the Brodie Chemical and Superphosphate works at Smith's Falls of a furnace for pyrites burning is an interesting feature. These works formerly used only imported sulphur, but with the change made they are now able to use either that or pyrites for making their acid.

SALT.

SALT.

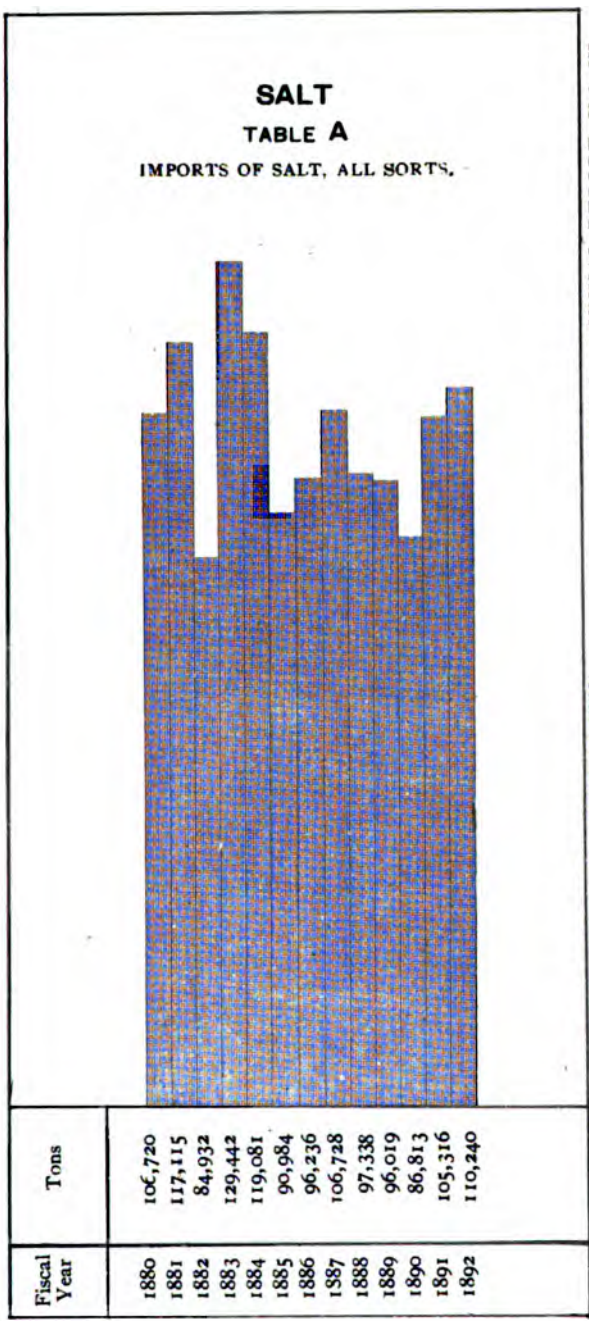
Production.

PRODUCTION.

The production of salt for 1892 was 45,486 tons valued at \$162,041, which figures on comparison are found to be almost identical with those of last year. The figures below give the production for the past

SALT
 TABLE A

IMPORTS OF SALT, ALL SORTS.



197s

years from which a comparison can be made with the present condition of the industry.

1886.....	62,359 tons, valued at \$227,195
1887.....	60,173 " " 166,394
1888.....	59,070 " " 185,460
1889.....	32,832 " " 128,547
1890.....	43,754 " " 198,897

EXPORTS AND IMPORTS.

Exports and imports.

The following tables, Nos. 1, 2 and 3, with graphic table A, give details of the exports and imports :—

SALT.

TABLE 1.
EXPORTS.

Year.	Bushels.	Value.
1880.....	467,641	\$46,211
1881.....	343,208	44,627
1882.....	181,758	18,350
1883.....	199,733	19,492
1884.....	167,029	15,291
1885.....	246,794	18,756
1886.....	224,943	16,886
1887.....	154,045	11,528
1888.....	15,251	3,987
1889.....	8,557	2,390
1890.....	6,605	1,667
1891.....	5,290	1,277
1892.....	2,000	504

SALT.

TABLE 2.
IMPORTS: SALT PAYING DUTY.

Fiscal Year.	Pounds.	Value.
1880.....	726,640	\$ 3,916
1881.....	2,588,465	6,355
1882.....	3,679,415	12,318
1883.....	12,136,968	36,223
1884.....	12,770,950	38,949
1885.....	10,397,761	31,726
1886.....	12,266,021	39,181
1887.....	10,413,258	35,670
1888.....	10,509,799	32,136
1889.....	11,190,088	38,968
1890.....	15,135,109	57,549
1891.....	15,140,827	59,311
1892.....	18,648,191	65,963

SALT.

SALT.

TABLE 3.

IMPORTS: SALT NOT PAYING DUTY.

Fiscal Year.	Pounds.	Value.
1880.....	212,714,747	\$400,167
1881.....	231,640,610	488,278
1882.....	166,183,962	311,489
1883.....	246,747,113	386,144
1884.....	225,390,121	321,243
1885.....	171,571,209	255,719
1886.....	180,205,949	255,359
1887.....	203,042,332	285,455
1888.....	184,166,986	220,975
1889.....	180,847,800	253,009
1890.....	158,490,075	252,291
1891.....	195,491,410	321,239
1892.....	201,831,217	314,995

Discovery and
development.

DISCOVERY AND DEVELOPMENT.

The greater proportion of the above production is to be credited as in former years to the province of Ontario, a small amount only being produced in New Brunswick. Most of the producers in Ontario worked this year as members of the Canada Salt Association.

Regarding boring for salt in the Ontario district, Mr. Brumell makes the following statement :—

Mooretown.

“ Two wells were begun in Lambton county during the year, one of which was successfully carried through to the salt-bed which was found at 1,643 feet and penetrated fifty feet. This well was sunk for Messrs. Brown and Armstrong at Mooretown, the driller being Major John Savage of Petrolea, to whom we are indebted for the following record :—

	Feet.
Clay and hardpan.....	145
Black and gray shale.....	355
Limestone.....	40
Shale with limestone.....	235
Limestone.....	250
Gypsum.....	65
Limestone and dolomite.....	210
Salt.....	3
“ Sandstone ” (?).....	30
Limestone or dolomite (gas).....	187
Dolomite.....	73
Gypsum, red shale and salt.....	42
“ Black rock ”.....	8
Salt.....	50
Total depth.....	1,693

"The boring finished in salt which is of good quality, salt water SALT. was encountered at 868 feet and mineral water with gas at 1,125 feet. Discovery and development. A small flow of gas was also found at 1,420 feet. Casing was carried to a depth of 902 feet.

"The well is located on the east side of the road, about sixty feet from the St. Clair river, the water from which will be used in the production of brine.

"The second well spoken of above was being sunk by Messrs. Webster Brothers, and is located about one-quarter of a mile to the north of that just described. Boring operations, at the time of my visit to the district, were at a standstill owing to the tools having become stuck at a depth of 900 feet.

"In Essex county, at the Canadian Pacific Railway station in Windsor, Windsor, a well was begun on the 28th July and finished 1st December, when it had been carried to a depth of 1,272 feet. No record of the rocks traversed is at hand, the only data available being the following, supplied by the driller, Mr. John J. Mason of Bay City, Mich.

"The surface deposits measured 128 feet in thickness and in the first rock at a depth of 142 feet from the surface a small show of oil is said to have been found; no gas was noted. Sulphurous water was struck at 350 and 480 feet, and at 1,125 feet a small quantity of salt water was found. Casing was carried to a depth of 685 feet. The first salt bed was found at 1,127 feet and consisted of forty feet of solid salt, while the second bed was struck at 1,188 feet or twenty-one feet below the first. This was penetrated for seventy-nine feet, the boring ceasing in salt."

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Building Stone.—During the year 1892 the value of the production of building stone fell off considerably, the output being 219,747 cubic yards, valued at \$609,827, which shows a decrease in value of \$98,909, while there was an increase in quantity of 32,062 cubic yards. The comparatively low price obtained during the year is accounted for by the fact that there were large quantities of low priced stone and much less high-priced building stone used than in former years, as a result of this many of the quarries producing a finer quality of sandstone and large dimension stone were closed down for a greater part of the year. Building stone.

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The production, by provinces, during the year, as reported to this office, was as follows :—

STRUCTURAL MATERIALS.

TABLE 1.

PRODUCTION OF BUILDING STONE.

Province.	No. of Returns.	Cub. Yds.	Value.
Ontario.....	48	147,264	\$378,574
Quebec.....	19	43,412	150,925
Nova Scotia.....	18	9,534	25,460
New Brunswick.....	6	2,024	12,481
Prince Edward Island.....	1	280	336
Manitoba.....	6	14,353	34,700
North-west Territories.....	3	2,400	2,800
British Columbia.....	1	480	4,550
Totals.....	102	219,747	\$609,827

The production during the past six years, compiled from direct returns made to this office, was as follows :—

1886.....	165,777 cubic yards, valued at \$642,509
1887.....	262,592 " " 552,267
1888.....	411,570 " " 641,712
1889.....	341,337 " " 913,691
1890.....	382,563 " " 964,783
1891.....	187,685 " " 708,736

It must, however, be borne in mind that these amounts are not complete, as it has been found impossible to obtain returns from all the many small quarries opened for local use. They represent, however, about four-fifths of the total production.

The following tables are of exports and imports and explain themselves :—

Exports and
imports.

STRUCTURAL MATERIALS.

TABLE 2.

EXPORTS OF STONE AND MARBLE, WROUGHT AND UNWROUGHT.

Province.	Wrought.		Unwrought.	
	1891.	1892.	1891.	1892.
Ontario.....	\$ 1,804	\$ 19	\$23,311	\$18,365
Quebec.....		1,660		2,010
Nova Scotia.....	300	208	12,793	15,485
New Brunswick.....	9,105	5,811	9,323	11,275
British Columbia.....	2,189	..	735	289
Totals.....	\$13,398	\$7,698	\$46,162	\$47,424

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TABLE 3.

IMPORTS OF BUILDING STONE.

Fiscal Year.	Value.
1880.. .. .	\$ 35,970
1881.. .. .	58,149
1882.. .. .	33,623
1883.. .. .	35,061
1884.. .. .	51,088
1885.. .. .	30,491
1886.. .. .	41,675
1887.. .. .	54,368
1888.. .. .	86,373
1889.. .. .	100,314
1890.. .. .	132,155
1891.. .. .	170,890
1892.. .. .	95,550

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Exports and imports.

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TABLE 4.

IMPORTS OF MANUFACTURES OF STONE OR GRANITE, N.E.S.

Fiscal Year.	Value.
1880.. .. .	\$29,408
1881.. .. .	36,577
1882.. .. .	37,267
1883.. .. .	45,636
1884.. .. .	45,290
1885.. .. .	39,867
1886.. .. .	41,984
1887.. .. .	41,829
1888.. .. .	47,487
1889.. .. .	61,341
1890.. .. .	84,396
1891.. .. .	61,051
1892.. .. .	39,479

As may be seen on reference to the foregoing tables, there was an approximate market in Canada for building stone as follows :

Production	\$609,827
Imports, building stone.....	95,550
Imports, stone and granite..	39,497
	\$744,874
Less—Exports wrought stone	7,698
“ unwrought stone	47,424
	55,122
	\$689,752

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Marble.

Marble.—The production of marble during the past year is altogether that of Ontario and amounted to 340 tons, valued at \$3,600, an increase over the previous year of 100 tons and \$1,848.

During the previous six years the production was as follows :—

1886	501 tons, valued at	\$9,900
1887	242 “ “	6,224
1888	191 “ “	3,100
1889	83 “ “	980
1890	780 “ “	10,776
1891	240 “ “	1,752

In the following table will be found the imports since 1880 :—

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TABLE 5.

IMPORTS OF MARBLE.

Imports.

Fiscal Year.	Value.
1890.....	\$ 63,015
1881.....	86,977
1882.....	109,505
1883.....	128,520
1884.....	108,771
1885.....	102,835
1886.....	117,752
1887.....	104,250
1888.....	94,681
1889.....	118,421
1890.....	99,353
1891.....	107,661
1892.....	106,268

Regarding operations in Cape Breton, N.S., where there are extensive crystalline limestone beds, Mr. H. P. Brumell reports as follows :—

Marble Mountain, N.S.

“ *Marble Mountain, Inverness County, N.S.*—The Bras d’Or Marble Company own and intend operating a property immediately to the north of the Bras d’Or Lime Company’s property on the west side of West Bay, Bras d’Or lake.

“ The measures naturally exposed and those uncovered by trenching and stripping consist of alternate bands of different thicknesses of white to dark gray, dark and light blue, yellow, pink and green crystalline limestones, very free from pyrites and mud spots, the whole striking east and west and dipping vertically. Small quantities only have been shipped and polished as samples. No regular work has yet been undertaken in the matter of quarrying though the company have on the ground a full equipment for operations on a small scale. The plant and material available consist of one channelling

machine, one set of gang saws, and material for the construction of a **STRUCTURAL MATERIALS.**
mill."

Granite.—The production of granite during the year was 24,302 Granite tons, valued at \$89,326, showing an increase over the year previous of 10,665 tons, valued at \$19,270.

By provinces the production was as follows :—

Ontario.....	2,642 tons, valued at \$	4,951
Quebec.....	7,324 " "	29,775
Nova Scotia.....	4,235 " "	27,600
New Brunswick....	2,800 " "	16,900
British Columbia....	7,301 " "	10,100

During the past six years the annual production was as follows :—

1886.....	6,062 tons, valued at \$	63,309
1887.....	21,217 " "	142,506
1888.....	21,352 " "	147,305
1889.....	10,197 " "	79,624
1890.....	13,307 " "	65,985
1891.....	13,637 " "	70,056

Slate.—During the year there was a production of slate of 5,180 Slate tons, valued at \$69,070, an increase over that of last year owing to the opening of several new quarries. This production is that of British Columbia and Quebec, wherein operations were carried on by several companies. A considerable amount of development work was done in the province of Quebec from which, during next year, an increased production may be looked for.

The figures of exports and imports during past years are given below and explain themselves :—

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TABLE 6.

EXPORTS OF SLATE.

Year.	Tons.	Value.
1884.....	539	\$6,845
1885.....	346	5,274
1886.....	34	495
1887.....	27	373
1888.....	22	475
1889.....	26	3,303
1890.....	12	153
1891.....	15	195
1892.....	87	2,038

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TABLE 7.

Imports.

IMPORTS OF SLATE.

Fiscal Year.	Value.
1880.....	\$21,431
1881.....	22,184
1882.....	24,543
1883.....	24,968
1884.....	28,816
1885.....	28,169
1886.....	27,852
1887.....	27,845
1888.....	23,151
1889.....	41,370
1890.....	22,871
1891.....	46,104
1892.....	50,441

Flagstones.

Flagstones.—The production of flagstones for 1892 amounted to 13,700 square feet, valued at \$1,869, a decrease compared with the previous year of 13,600 square feet and in value of \$852. This production is altogether that of Quebec, in the vicinity of Dudswell, and of Cape Breton, in Nova Scotia. It is, however, known that a certain quantity was produced in Ontario although no returns were received from that province.

During the past six years the annual production has been as follows :—

1886.....	70,000 feet, valued at \$	7,895
1887.....	116,000 “ “	11,600
1888.....	64,800 “ “	6,580
1889.....	14,000 “ “	1,400
1890.....	17,865 “ “	1,643
1891.....	27,300 “ “	2,721

No exports of flagstones are reported; the imports are given in the following table :—

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TABLE 8.

IMPORTS OF FLAGSTONES.

Imports.

Fiscal Year.	Tons.	Value.
1881.....	23	\$ 241
1882.....	90	848
1883.....	10	99
1884.....	137	1,158
1885.....	205	1,756
1886.....	1,602	9,443
1887.....	1,316	10,966
1888.....	2,642	21,077
1889.....	1,669	15,451
1890.....	5,665	48,995
1891.....	3,770	36,348
1892.....	1,571	15,048

Cement.—During the year there was a production of cement of 107,408 barrels valued at \$147,663, an increase over the previous year of 13,935 brls. and \$39,102. This production is that of twelve operators, all of the provinces of Quebec and Ontario, wherein the greater part of the output was consumed. The Portland cement manufactured in Canada is to a large extent replacing that of foreign make, as may be seen in reference to table 11 following.

During the past five years the annual production was as follows :—

1887.....	69,843 barrels, valued at \$	81,909
1888.....	50,668 “	35,593
1889.....	90,474 “	69,790
1890.....	102,216 “	92,405
1891.....	93,473 “	108,561

In 1892 the production of both natural and Portland cement was :—

Natural cement,	88,187 barrels, valued at	\$99,912
Portland “	29,221 “	52,751

Of the state of the industry but little can be said beyond the fact that there was a very considerable growth in the production of Portland cement, of which a large quantity now enters into the home market.

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The following tables illustrate the imports of building cements of all kinds; the exports will be found grouped with those of lime.

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TABLE 9.

IMPORTS OF CEMENT IN BULK OR BAGS.

Fiscal Year.	Bushels.	Value.
1880.....	65	\$ 28
1881.....	579	298
1882.....	386	86
1883.....	1,759	548
1884.....	4,626	1,236
1885.....	4,598	1,315
1886.....	6,808	1,851
1887.....	5,421	1,419
1888.....	23,919	5,787
1889.....	32,818	10,668
1890.....	21,055	5,443
1891.....	11,281	2,890
1892.....	14,351	3,394

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TABLE 10.

IMPORTS OF HYDRAULIC CEMENT.

Fiscal Year.	Barrels.	Value.
1880.....	10,034	\$ 10,306
1881.....	7,812	7,821
1882.....	11,945	13,410
1883.....	11,659	13,755
1884.....	8,606	9,514
1885.....	5,613	5,396
1886.....	6,164	6,028
1887.....	6,160	8,784
1888.....	5,636	7,522
1889.....	5,835	7,467
1890.....	5,440	9,048
1891.....	3,515	6,152
1892.....	2,214	2,782

Imports.

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TABLE 11.

IMPORTS OF PORTLAND CEMENT.

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Fiscal Year.	Barrels.	Value.
1880.....		\$ 55,774
1881.....		45,646
1882.....		66,579
1883.....		102,537
1884.....		102,857
1885.....		111,521
1886.....		120,398
1887.....	102,750	148,064
1888.....	122,402	177,168
1889.....	122,273	179,406
1890.....	192,322	313,572
1891.....	183,728	304,648
1892.....	187,233	281,553

Roofing Cement.—Of roofing cement there was during the year a production of 800 tons, valued at \$12,000, an increase in value over the previous year of \$7,190. Roofing cement.

Lime.—There was a very marked increase in the production of lime during the past year, the quantity being 2,260,640 bushels, valued at \$411,270. Full returns are not, however, possible to obtain, though all the largest and more important producers' outputs are included here. The production by provinces and the annual production for the past six years are given in the following tables :—

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TABLE 12.

PRODUCTION OF LIME.

Province.	No. of Returns	Bushels.	Value.
Ontario.....	56	850,474	\$110,156
Quebec....	11	530,505	116,347
Nova Scotia.....	5	70,775	20,540
New Brunswick.....	12	491,050	98,359
Prince Edward Island....	3	13,575	3,413
Manitoba.....	11	210,046	39,372
British Columbia.....	4	88,915	20,363
North-west Territories....	3	5,300	2,720
Totals.....	105	2,260,640	\$411,270

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TABLE 13. .

ANNUAL PRODUCTION OF LIME.

Year.	No. of Returns	Bushels.	Value.
1886.....	87	1,535,950	\$283,755
1887.....	133	2,269,087	394,859
1888.....	93	2,216,764	339,951
1889.....	106	2,948,249	362,848
1890.....	93	2,501,079	412,308
1891.....	83	1,829,894	251,215

Exports and
imports.

The exports of lime and cement and the imports of lime are given
in the following tables :—

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TABLE 14.

EXPORTS OF LIME AND CEMENT.

Province.	Lime and Cement.		1891.		1892.	
	1889.	1890.	Lime.	Cement.	Lime.	Cement.
Ontario.....	\$ 12,877	\$ 17,341	\$ 19,390	\$2,534	\$ 19,383	\$399
Quebec.....	71	.....	25,446	283	26,586	539
Nova Scotia.....	11,017	17,137	15,387	64	644	.....
New Brunswick ..	135,222	130,180	59,318	.....	74,912	.....
Prince Edward Isl'd	2	5	12	.....	.....	.....
Manitoba.....	2,060	.....	.....	.....	.....	.....
British Columbia...		4,141	300		10	
Totals.....	\$161,249	\$168,804	\$119,853	\$2,881	\$121,535	\$938

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TABLE 15.

IMPORTS OF LIME.

Fiscal Year.	Barrels.	Value.
1880	6,100	\$ 6,013
1881	5,796	4,177
1882	5,064	5,365
1883	7,623	9,224
1884	10,804	11,200
1885	12,072	11,503
1886	11,021	9,347
1887	10,835	8,524
1888	10,142	7,537
1889	13,079	9,363
1890	8,149	5,360
1891	6,259	4,273
1892	6,132	4,241

Regarding recent operations in Nova Scotia, Mr. H. P. Brumell reports as follows :—

Cape Breton County.

" *Marble Mountain.*"—"The Bras d'Or Lime Company have extensive works at Clark's cove, Marble mountain, West bay, where large quantities of a very superior quality of lime are annually produced. The works have a capacity of two hundred and forty barrels per day, with trams running from the three quarries opened by the company. The rock used in the manufacture of lime is a dark blue-gray banded crystalline limestone, which is found to make a much stronger and more lumpy material than the many lighter coloured varieties of limestone in the district. Marble Mountain, N.S.

"Shipments are made altogether by water, the works being located on the north-west side of West bay. During the summer months raw stone is shipped to Halifax where during the winter it is burnt for local supply and export.

"The works at West bay are probably the most complete and largest in Canada and consist of :

Two draw kilns ;

One saw-mill containing one 55 horse-power boiler, one 45 horse power engine, one circular saw, one cylinder saw, one head turner, one head cutter, two stave jointers, one bolter saw, one dowelling machine ;

One cooper shop ;

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One lime storehouse, three stories, 100 x 120 feet ;
 One store ;
 One manager's house, barns, sheds, etc. ;
 Three tenement houses ;
 One steam lighter."

Bricks.

Building Brick.—During the year, 1892, there was a production of building brick of 202,147 thousands, valued at \$1,251,934, showing a marked increase over the production of the year previous, as may be seen on reference to the following figures of annual production during the past six years :—

1886.....	139,345 M	valued at \$	873,600
1887.....	181,581 "	"	986,689
1888.....	165,818 "	"	1,036,746
1889.....	200,561 "	"	1,273,884
1890.....	211,727 "	"	1,266,982
1891.....	176,533 "	"	1,061,536

These figures, as also are those in the following tables, are not considered actually correct and are supposed to represent about four-fifths of the total production. The following table represents the production by provinces :—

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TABLE 16.

PRODUCTION OF BRICKS DURING 1892.

Province.	No. of Returns.	Thousands.	Value.
Ontario.....	235	129,702	\$778,212
Quebec.....	27	34,797	191,383
Nova Scotia.....	20	13,761	89,446
New Brunswick.....	8	4,649	32,543
Prince Edward Island..	3	442	3,536
Manitoba.....	5	7,700	65,450
North-west Territories..	6	2,375	24,937
British Columbia.....	7	8,721	66,427
Totals.....	311	202,147	\$1,251,934

There was a small exportation of bricks during the year, as follows :—

Ontario.....	1,347 M	\$ 8,784
Quebec.....	353 "	1,566
Nova Scotia.....	252 "	1,662
New Brunswick.....	10 "	170
Prince Edward Island.....	1 "	10
Total.....	1,963 M	\$12,192

The imports since 1880 are shown in the following table:—

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TABLE 17.

IMPORTS OF BUILDING BRICK.

Imports.

Fiscal Year.	Value.
1880.....	\$ 2,067
1881.....	4,251
1882.....	24,572
1883.....	14,234
1884.....	20,258
1885.....	14,632
1886.....	5,929
1887.....	2,440
1888.....	20,720
1889.....	24,585
1890.....	12,500
1891.....	9,744
1892.....	5,075

Terra Cotta.—The value of terra cotta produced during 1892 was Terra Cotta. \$97,239, a decrease in comparison with the year previous of \$15,864.

Drain Tile.—The production of drain tiles during the year, accord^d Drain Tile. ing to returns made to this office, was 15,689 thousands, valued at \$190,857. These figures are not, however, supposed to represent over two-thirds of the total production, which, owing to the scattered position of the works, it was found impossible to obtain. The following table illustrates the production by provinces:—

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TABLE 18.

PRODUCTION OF TILES DURING 1892.

Province.	No. of Returns.	Thousands.	Value.
Ontario.....	106	15,303	\$183,636
Quebec.....	1	63	756
Nova Scotia.....	3	61	915
New Brunswick.....	3	154	2,310
British Columbia.....	2	108	3,240
Totals.....	115	15,689	\$190,857

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During the past six years the annual production was as follows:—

1886.....	12,416 M,	valued at \$142,617
1887.....	14,658 “	“ 230,068
1888.....	7,518 “	“ 114,057
1889.....	10,526 “	“ 134,265
1890.....	10,521 “	“ 140,877
1891.....	11,839 “	“ 141,399

The imports, if any, are included with those of sewer pipes in the following table. No exports are reported.

Sewer Pipe.—The production of sewer pipe during 1892 was valued at \$367,660, an increase over the year previous of \$140,360. No further statistics beyond those of imports given below are available.

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TABLE 19.

IMPORTS OF DRAIN TILES AND SEWER PIPE.**Imports.**

Fiscal Year.	Value.
1880.....	\$ 33,796
1881.....	37,368
1882.....	70,065
1883.....	70,699
1884.....	71,755
1885.....	69,589
1886.....	57,953
1887.....	71,203
1888.....	101,257
1889.....	83,215
1890.....	77,434
1891.....	87,195
1892.....	59,537

Pottery.

Pottery.—According to returns received at this office, there was a production during 1892 of pottery to the value of \$265,811, an increase compared with the previous year of \$6,967. The production by provinces is given as follows:—

Ontario.....	\$ 91,160
Quebec.....	148,251
Nova Scotia.....	3,200
New Brunswick.....	18,000
Prince Edward Island.....	3,000
Manitoba.....	2,000
British Columbia.....	200

Total.....	<u>\$265,811</u>
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No exports, as such, are reported, the only trade statistics being **STRUCTURAL MATERIALS.** those of imports given below :—

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TABLE 20.

IMPORTS OF EARTHENWARE.

Imports.

Fiscal Year.	Value.
1880.....	\$322,333
1881.....	439,029
1882.....	646,734
1883.....	657,886
1884.....	544,586
1885.....	511,853
1886.....	599,269
1887.....	750,691
1888.....	697,082
1889.....	697,949
1890.....	695,206
1891.....	634,907
1892.....	748,810

Sand and Gravel.—No returns were asked for nor received bearing **Sand and Gravel.** on the production of sand and gravel in Canada during the year 1892. The only statistics available are those of exports, as follows :—

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TABLE 21.

EXPORTS OF SAND AND GRAVEL.

Exports.

Province.	1891.		1892.	
	Tons.	Value.	Tons.	Value.
Ontario.....	243,294	\$58,283	297,406	\$84,311
Quebec.....			25	30
Nova Scotia.....	230	805	175	703
New Brunswick.....	200	400	150	150
Manitoba.....			72	42
British Columbia.....		13	50	93
Totals.....	243,724	\$59,501	297,878	\$85,329

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TABLE 22.

EXPORTS OF SAND AND GRAVEL.

Year.	Tons.	Value.	Year.	Tons.	Value.
1877	11,998	\$ 2,151	1885	110,661	\$22,878
1878	50,140	8,381	1886	124,865	24,226
1879	46,999	9,438	1887	180,860	30,307
1880	53,951	11,177	1888	260,929	38,398
1881	58,693	15,129	1889	283,044	52,647
1882	60,158	16,218	1890	342,158	65,518
1883	55,346	14,065	1891	243,724	59,501
1884	73,741	19,978	1892	297,878	85,329

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(NEW SERIES.)

ABBREVIATIONS.

Al.	District of Alberta.	N.W.T.	North-west Territory.
As.	District of Assiniboia.	O.	Province of Ontario.
B.C.	Province of British Columbia.	P.E.I.	Prince Edward Island.
Ma.	Province of Manitoba.	Q.	Province of Quebec.
N.B.	Province of New Brunswick.	Sk.	District of Saskatchewan.
N.S.	Province of Nova Scotia.		

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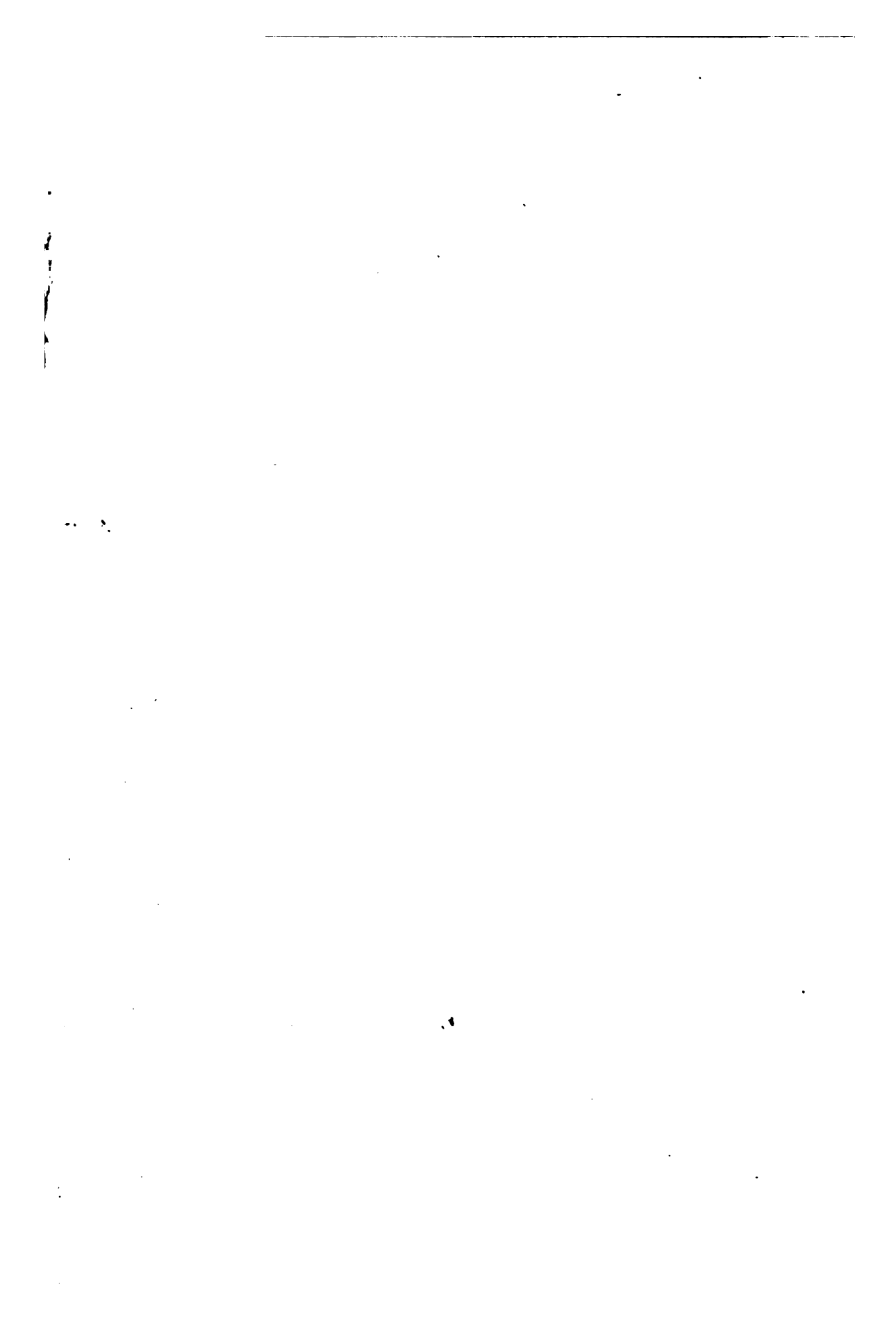
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